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JOURNAL
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THE SANITARY INSTITUTE.

THE LESSONS TO BE LEARNT FROM THE EXPERIMENTAL INVESTIGATIONS BY THE STATE BOARD OF HEALTH OF MASSACHUSETTS UPON THE PURIFICATION OF SEWAGE.

By Captain Sir Douglas Galton, K.C.B., D.C.L., LL.D., F.R.S., Late R.E., Hon. M.Inst.C.E.
(Fellow.)

Read at a Sessional Meeting, December 11th, 1895.

I have been requested to open a discussion upon some of the general conclusions which may be drawn from the Massachusetts experiments. These have been published for some time, and they have been elaborated by further efforts of engineers both in this country and in America.

My task is to endeavour to give you a brief account of the various experiments which have been made, and to present to you the conclusions to which these various experiments point. My remarks are only intended to open out what we hope may be a valuable discussion on this important subject.

It has practically only been in comparatively recent times that the growth of our population has compelled the public to recognise the necessity for the disinfection, purification, or destruction of refuse matter.

A sparse population could afford to allow the refuse to purify itself gradually in the soil, or in ditches, streams, and rivers; but as the population and proximity of habitations increase, careful attention must be given to methods of dealing with the refuse to prevent the injurious effects which arise from decaying organic matter in the neighbourhood of dwellings, or from the use of polluted water in our streams and wells.

As a result of the epidemics of cholera between 1830 and 1850, the removal of excreta by water carriage obtained a great development, and during the discussions which took place upon the problem of Metropolitan Drainage before 1858, the utilization of sewage and its purification by application to land received much consideration. The problem was in the hands of the engineer and the chemist, and the conclusions at which experts in sewage then arrived may be generally summed up as follows:—

1st. The direct application of sewage to land is thoroughly effective as a means of purification. There is no sanitary objection whatever to the system of sewage disposal by agricultural irrigation, and no nuisance or offence can arise in connection with it, save as a result of gross neglect or mismanagement. But it entails difficulties in thickly settled districts, owing to the extent of land required.

2nd. The chemical treatment of sewage produces an effluent harmless only after having been passed over land, or if turned into a large and rapid stream or into a tidal estuary, and it leaves behind a large amount of sludge to be dealt with.

3rd. Hence it was long contended that the simplest plan in favourable localities was to turn the sewage into the sea, and that the consequent loss to the land of the manurial value in the sewage would be recouped by the increase in fish life.

Purification was originally supposed to be due to the oxidising effect of the air, but the researches of Schloessing, in France, and Frankland and Warrington, in England, brought the biological element into consideration.

Schloessing found that when sewage was passed through baked sand and marbles, no purification was produced at first, but that later the effluent became clear and free from organic matter. He found that this purification was arrested by the presence of chloroform in the sand, and that it began again when the chloroform was washed out. This confirmed him in the conclusion that purification requires the co-operation of living organisms.

Warrington believed that nitrification was due to living organisms chiefly confined to the surface soil. And Frankland concluded that purification is a process of oxidation, producing carbonic acid and nitric acid, and that a continual aeration of the soil is necessary.

The conclusion was thus reached that in the direct application of sewage to land, the loam on the surface at once supplies nitrifying organisms ready to convert the sewage into a form suited for food for the plants which are on the land.

Dr. Frankland, many years ago, suggested the intermittent filtration of sewage through a thickness of five or six feet of material; and Mr. Bailey Denton and Mr. Baldwin Latham were among the earlier engineers who adopted the method.

The simplest theory of the working of any filter is that its action is mechanical, indeed the word "filter" has come to mean ordinarily a more or less perfect strainer. In this aspect the working of the filter is continuous, but it soon chokes and must be cleaned.

The intermittent filter on the other hand presents quite different conditions. It is no longer a mere mechanical strainer. No doubt when first established there may be a period at the outset when it effects little more than a mechanical purification; but, under the best conditions, there speedily begins a change of the profoundest significance. The filter becomes a method of developing the conditions which favour the action of bacteria by the exposure of the sewage in the presence of air.

The Massachusetts experiments may be said to have taken up the question at this point. The experiments show that a sand filter does not effect the nitrification when first used. Time is necessary for it to accumulate a suitable colony of bacteria. Furthermore, the colony adjusts itself to the work it has to do. If, then, the amount of sewage is suddenly increased, and is continued at the larger amount, the nitrification will at first be incomplete, but the bacteria will soon multiply and purification will again become satisfactory, often amounting to the destruction of 99½ per cent. of the nitrogenous matters in the sewage, and all but a fraction of one per cent. of the bacteria.

Nitrification is affected by the season and by temperature. It is most active in the growing months of May and June—even more so than in the hotter months of July and August. With this exception the amount of nitrification varies with the amount of the sum of the ammonias in the sewage, so that, in the winter months of 1888-89, while the nitrates of the effluent were lower than at other times, it was found that the sum of the ammonias in the sewage was also lower, and *that nitrification at that time was quite as complete as in the previous months.*

The general conclusions were thus summed up in the report of the chemist to the experiments, Mr. Hazen:

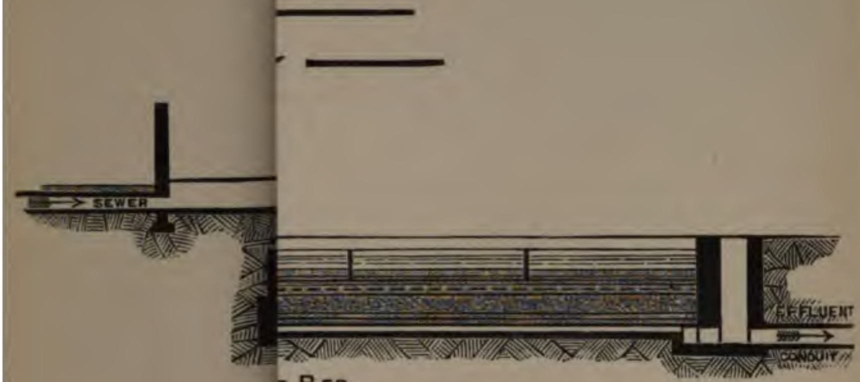
"The purification of sewage by intermittent filtration depends upon oxygen and time; all other conditions are secondary. Temperature has only a minor influence; the organisms necessary for purification are sure to establish themselves in a filter before it has been long in use. Imperfect purification, for any considerable period, can invariably be traced either to a lack of oxygen in the pores of the filter, or to the sewage passing so quickly through, that there is not sufficient time for the oxidation processes to take place. Any treatment which keeps all particles of sewage distributed over the surface of sand particles, in contact with an excess of air, for a sufficient time, is sure to give a well-oxidized effluent; and the power of any material to purify sewage depends almost entirely upon its ability to hold the sewage in contact with air. *It must hold both air and sewage in sufficient amounts.*"

As the object of this paper is simply to produce a discussion upon this interesting subject, I will not enter into those further details which are fully supplied in the report. But I will proceed to draw attention to certain methods which have been proposed by engineers, both in this country and in America, with the object of facilitating and regulating the aeration of filters. Mr. Lowcock in 1893 read a paper before the Institution of Civil Engineers in which he summarized the Massachusetts experiments, and showed the result of some further experiments of his own, in order "to ascertain the possibility of constructing and working a filter that should follow the operations of nature, and promote the growth of the nitrifying organisms and the consequent purification of a sewage effluent, when working continuously."

Mr. Lowcock's method was to supply air continuously under pressure into the body of the filter, so as to afford to the bacteria the necessary means of subsistence.

I annex a plan and two sections of Mr. Lowcock's filter, Figs. 1 and 2.

	Parts per 100,000.	
	Crude Sewage.	Effluent from Filter.
Free Ammonia	4·65	·04
Albuminoid Ammonia	2·40	·036
Total	7·05	·076
	Sewage after Precipitation in Tanks.	Effluent from Filter.
Free Ammonia	6·40	·008
Albuminoid Ammonia	·70	·022
Total	7·10	·030


SEWER
EFFLUENT
CONDUIT

R BED.

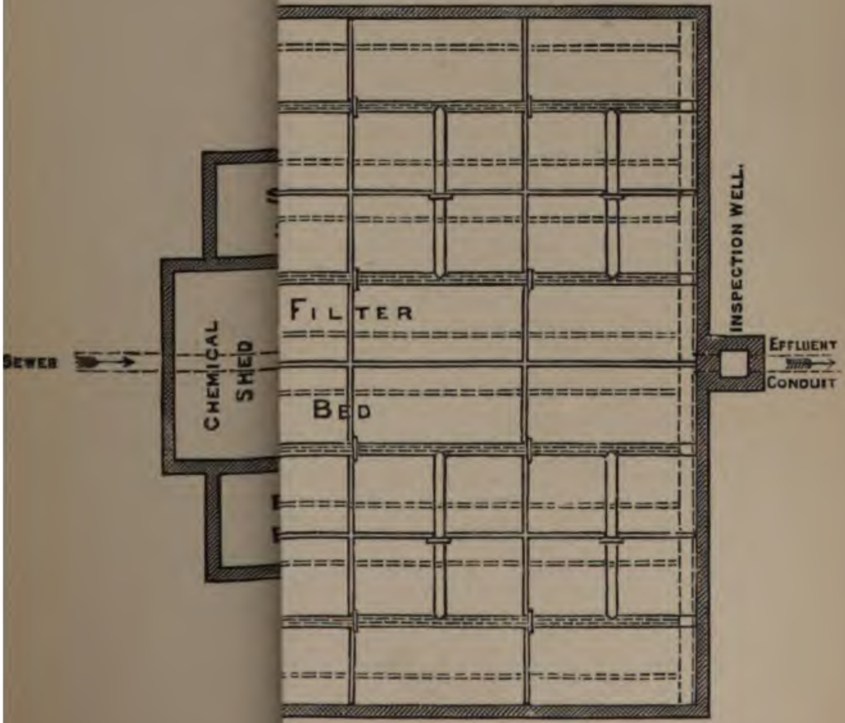
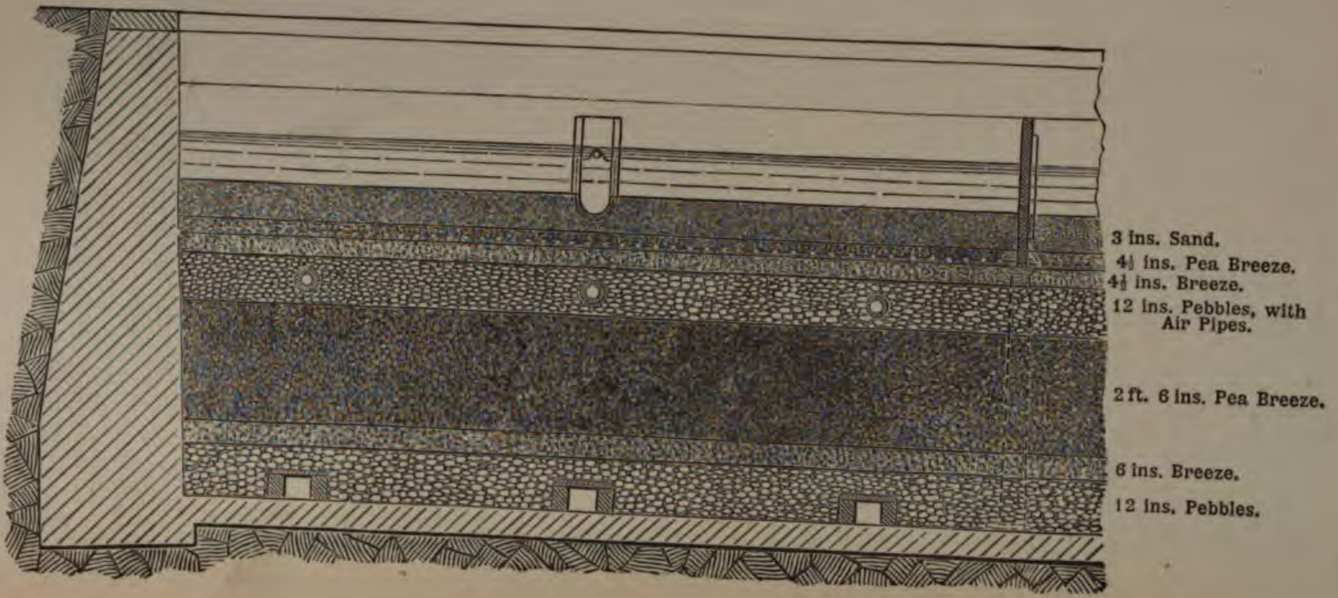

SEWER
CHEMICAL
SHED
FILTER
BED
INSPECTION WELL.
EFFLUENT
CONDUIT

Fig. 2.

LOWCOCK'S PATENT FILTER.

SECTION OF ONE DIVISION OF FILTER BED

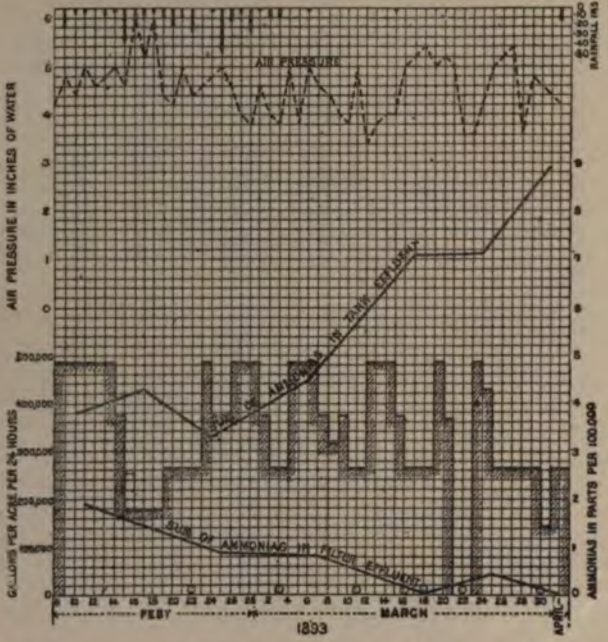
SCALE ¼ IN. TO A FOOT



Mr. Lowcock points out that "the practical difficulty with all filtration is the clogging of the surface, whilst this affects the quantity passed in an inverse ratio it also affects the degree of purification directly; that is to say, the greater the clogging of the surface, the more slowly does the liquid pass through the filter and the greater the consequent purification. It would appear, however, from the comparison of the experiments, that this clogging does not take place so quickly when air is being supplied to the body of the filter as when it is not; and this is probably due to the matters which produce the clogging being broken up and destroyed in the presence of the air directly they pass below the surface."

Mr. Lowcock's experiments coincide with the conclusions arrived at in the Massachusetts experiments, that the filter does not reach its condition of greatest efficiency for some little time after it is started, and that the efficiency is impaired by variations in the quantity of liquid applied.

The following Diagram, which is reproduced by permission from a paper read before the Institution of Civil Engineers, shows the general result obtained in the experiments:—



The average quantity applied during the period covered by the diagram is equal to 353,800 gallons per acre, per day, the average air-pressure being 4·5 inches of water. The quantity applied when the most satisfactory results were obtained was at the rate of 263,780 gallons per acre, per day; so that at this rate the area required per million gallons of effluent of the same impurity as that experimented with, would be 3·8 acres. The dry weather flow of the sewage experimented upon is 16 gallons per day per head of the population, so that the quantity treated at the most efficient rate is equal to that from 16,486 persons per acre.

In his later development for treating the Wolverhampton sewage, Mr. Lowcock has substituted coke breeze for gravel in the body of the filter, and improved the arrangement for distributing sewage over the surface of the filter. The following table summarizes Mr. Lowcock's results in October, 1895:—

Analysis of the effluent from the settling tank as applied to filter, and the resulting effluent from filter in parts per 100,000.

October 8th, 1895.	Tank Effluent applied to filter.	Effluent from filter.	Percentage of Reduction.
Free ammonia	4·00	1·20	70
Albuminoid ammonia	0·35	0·07	80
Oxygen consumed	1·70	0·40	77
Nitrogen as nitrites and nitrates	traces.	2·68	
Chlorine, grains per gallon	14·00	16·80	

The percentages of reduction are calculated on the tank effluent; if calculated on the sewage, the results of the whole treatment, tank and filter, would be a reduction of considerably over 90 per cent.

The Wolverhampton sewage is a most difficult one to deal with, as it contains a large quantity of manufacturers' and acid waste.

As regards the refuse from dye-works and woollen factories, Mr. Lowcock states that his experiments appear to show that when the refuse is properly treated in tanks first, and the resultant tank effluent is slightly alkaline, there is no prejudicial effect on the filters or on the quality of the effluent; and in the treatment of refuse from dye-works the organic colouring matter is removed by the filter at the same time as the albuminoid ammonia.

Mr. Scott Moncrieff has also proposed a cultivation filter bed, which would seem to have been designed chiefly for Institutions or large residences.

"The filter bed is about 3 feet deep and 2½ feet wide, and 10 feet in length. The entire sewage discharge and waste waters from a household of from ten to twelve persons (with the exception of the grease, which is held back as far as possible by a grease trap) finds its way into one end of this filter bed. The liquid portion rises through a false bottom, and then through successive layers of flint, coke, and gravel, till it reaches the level of the overflow pipe, which is about two inches below the level of the invert of the drain. The depth of the filtering medium is only about fourteen inches. The cubic capacity of the filter bed is thus so small that the natural expectation would be that in a few days the filtering medium would become choked, and a nuisance result. As a matter of fact, however, the reverse of this happens, the effluent up to a certain point actually improving in quality as time goes on, and the whole process continuing to work satisfactorily and uninterruptedly for months together without constituting a nuisance."

The filter beds and channels are in duplicate to allow of periodical aeration.

My friend, Col. George Waring, the well-known sewage engineer in America, has pursued the same line of investigation upon a practical scale with a somewhat different arrangement from Mr. Lowcock's. He obtained permission in 1894 to treat a portion of the sewage of Newport, Rhode Island. The sewage was taken from "the main outlet sewer. . . . The sewer at this point is 5 ft. wide and 5 ft. deep, and with a grade of 1 to 2,000. At the end of the wharf, 104 ft. beyond the point selected, the sewer delivers into a large settling chamber, and from this an iron pipe, laid on the bottom of the inner harbour, leads beyond the breakwater and discharges into the main channel. A storm overflow in the settling chamber . . . allows the direct discharge of sewage into the inner harbour at times when the flow is unusually large. This overflow is provided with low tide gates, but very high tides sweep over these and flood the settling chamber with salt water. The city is sewered according to the combined system. The street inlets deliver into large catch-basins, which in dry weather are little better than cesspools. Many of the sewer connections are merely overflows from the cesspools, receiving only liquid which is stale and putrid.

"The main sewer, which of necessity has very little fall, is a sewer of deposit, in which putrefaction is constantly going on. Because of these conditions, the sewage used in the experiments was often far from 'fresh,' although the analyses showed it to be of normal composition and fair average strength. It contained practically no manufacturing wastes, although at times there was evidence of the presence of gas liquor. The sewage was raised by means of a 10-inch diaphragm pump, which was placed with a 3-inch galvanized iron suction running to within about 3½ inches of the bottom of the sewer.

"The mouth of this suction was open full bore, so that a fair sample of the sewage, solids as well as liquids, might be had . . . The capacity of the pump at full stroke was ·81 gallons, but its average throw during the experiment was about ·28 gallons, and its average speed was five to eight strokes per minute . . . A chemical laboratory was provided, suitably equipped for the determination of free and albuminoid ammonias, consumed oxygen, dissolved oxygen, chlorine, &c., and for the recording of meteorological conditions. The . . . pump delivered the flow . . . at will to either side of a partition which divided into two sections (for alternate use) a shallow bed of coarse broken stone . . . The function of this bed was to catch and retain the coarser solids contained in the sewage, before passing it to the tanks below." When one section was choked the flow was turned into the other. "The impurities in the section thrown out of use disappeared rapidly in its interval of rest."

The function of the straining tanks was mere mechanical sedimentation. Each tank had a diameter of about six feet at bottom; the outer sides slightly tapering inwards, and a depth of about five feet six inches, of which five feet was filled with the filtering material. See Illustrations on pages 10, 12, and 14.

"From the straining apron, the sewage, freed from its coarser solids, passed to the straining tanks. Of these there were originally four similar in construction, but filled with different materials. Each tank has a total capacity of about 985 gallons. The top of No. 1 was about four inches below the delivery of the straining apron, and each succeeding tank was six inches lower than the one next before it, so that the tanks could be used in series if desired, the overflow of No. 1 delivering into No. 2, the overflow from No. 2, in turn passing to No. 3, and so on. The internal arrangement of one of these tanks is shown in Fig. 3, page 10. *A* is a false bottom of plank, perforated with ¾-inch holes about four inches apart, and supported a few inches from the bottom on cleats. *B* is a galvanised iron air-pipe, six inches in diameter, branching from a 12-inch air main, and delivering through the false bottom into the open space below. *C* is a layer of coarse broken stone (1 to 2½-inch) six inches thick. . . . *D* is a cylindrical diaphragm, of hooped staves, resting upon the broken stone *C*, and dividing the surface of the tank into a circle and a ring of equal area. *E* is the material with which the main body of the tank, inside and outside of the diaphragm, was filled. In tank No. 2 it was fine broken stone (⅜ to ¾-inch); in No. 3, round pebbles, of diameter ranging from ⅜ to ⅝-inch; and No. 4, coarse white gravel, of very uniform size, free from sand, each grain being about ⅛-inch in diameter. Each of these tanks was fitted with a drainage cock F near its bottom, and a hole bored through the bottom and closed with a wooden plug *G*, provided means for the rapid and complete emptying of any tank when desired for the purposes of cleansing.

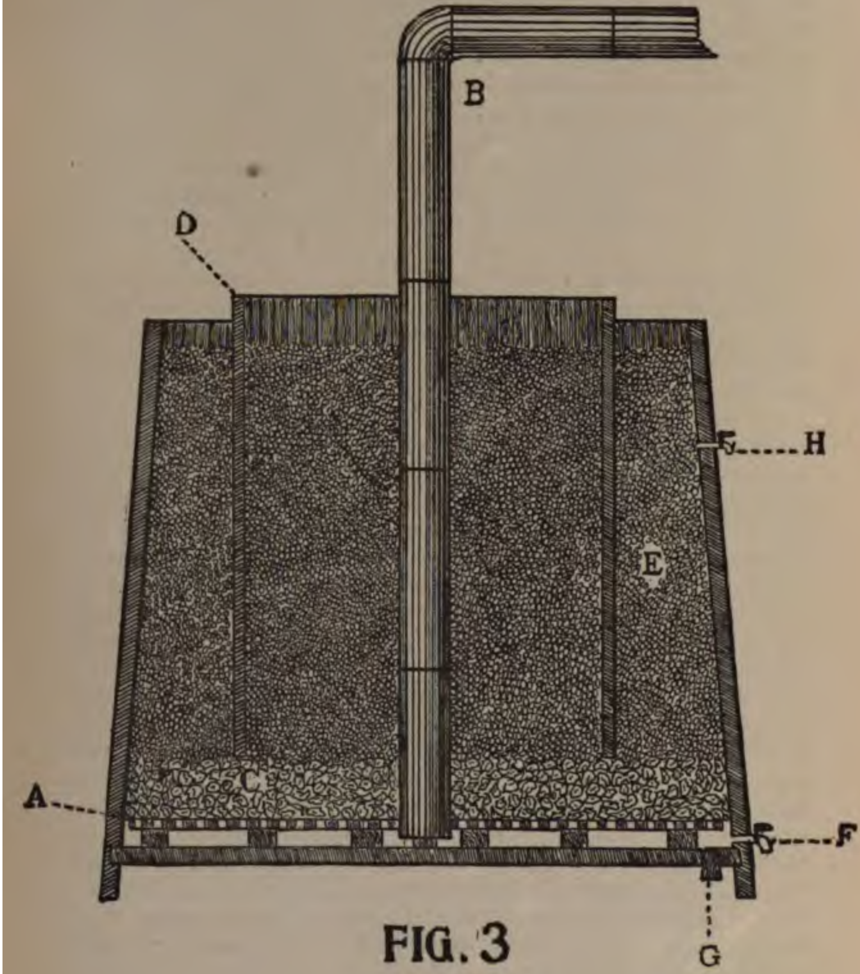


FIG. 3

"A smaller cock, *H*, was placed near the top of each tank, just below the overflow line, and from this samples were taken for analysis and examination. The partially strained sewage from the apron was delivered on the surface of one of these tanks in the circle enclosed by the diaphragm. It passed down through the central cylinder of filtering material and under the diaphragm, and rose again through the annular space outside of the diaphragm overflowing through a spout into a gutter. This gutter led the liquid either to the central circle of the next straining tank, when two or more of these tanks were used in series, or to the aerating tank, for further treatment."

As has been stated, the function of these four "strainers" was mere mechanical sedimentation. The liquid flowed slowly through them and the suspended matters, which were more or less fibrous or gelatinous in their nature, became attached to the particles of the filter, the coarser of them being deposited near the surface of the central cylinder and the finer progressing further and further into the mass. It was found that practically all of the solid matters were deposited in the central core during the downward flow of the water, and that very little work remained to be done as the liquid rose in the outside ring. This was the case when the sewage was applied at the maximum rate attained in the experiment, 8,950,194 gallons per acre, the water moving through the tank at the rate of about three feet per hour.

As a rule, sewage was passed through a strainer until the resistance from the collection of matter was so great that the liquid in the inner compartment overflowed the diaphragm. The rate at which this clogging matter gathered was very variable. It was noticed that an admixture of salt water materially increased it, evidently from precipitation of soap; and that putrefaction, as has been indicated, tended to decrease it by making soluble compounds.

The suspended matter or sludge thus removed from the sewage, mechanically, by the strainers was afterwards destroyed by emptying the strainer through the plug *G*. The liquid was drawn slowly through the cock, to prevent such disturbance of the sediment deposited upon the particles of the stone as a rapid flow would have caused. Air was then forced through the filter so as to induce bacterial action. By this means the cleansing was easily effected.

The effluent from the strainers was led to a distributing box, from which it escaped over a level weir, the flow being divided by movable knife-edge gates, which regulated the amounts applied to the aerators.

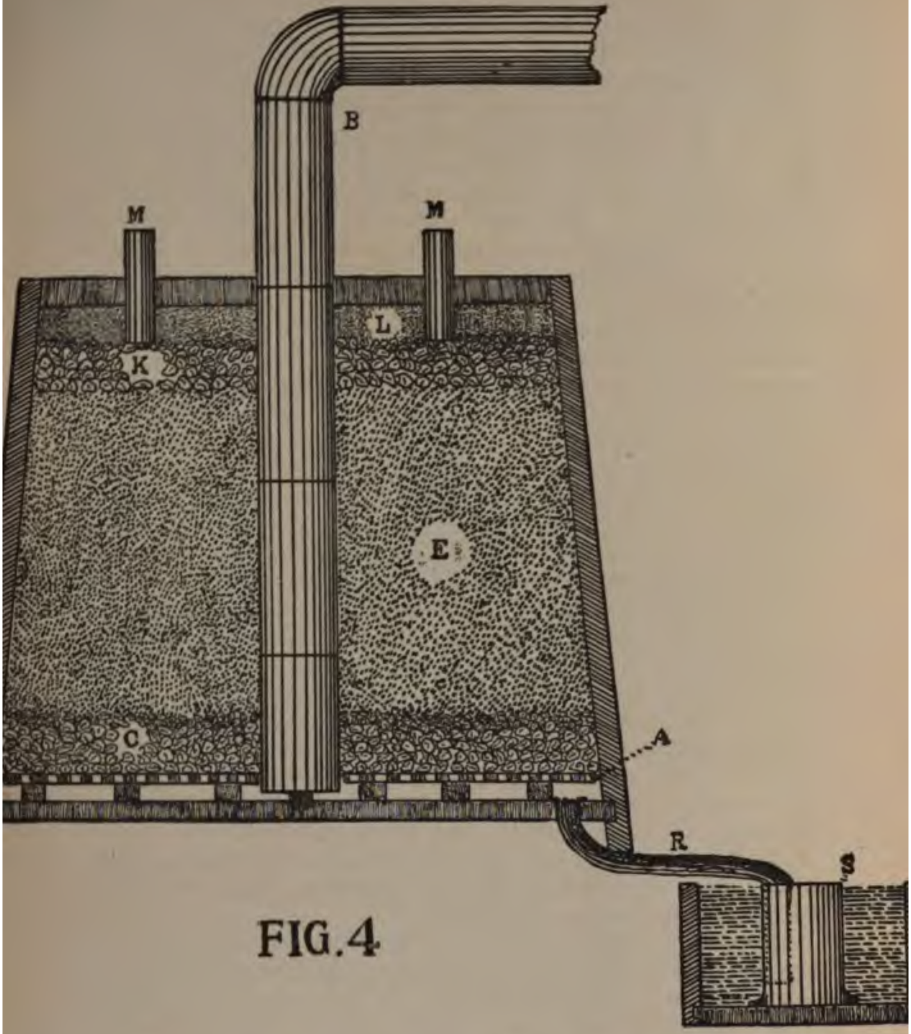


FIG. 4

The aerating tank is shown in Fig. 4. "This tank was of the same size as the others, and was set six inches lower than the strainer. "It had a perforated false bottom, with an 8-inch air-pipe delivering into the space below it. On this bottom was placed six inches of coarse broken stone *C*, which was packed at the top with smaller stone, so as to support firmly the finer filling material, which was clean white gravel *E*, each grain being about ⅛-inch in diameter . . . and 3 feet 9 inches deep. On this was placed another six inches of coarse broken stone *K*, packed with finer stone at the top, and the whole was covered with six inches of fine beach sand *L*. Two vent pipes *M M*, made of single lengths of round 4-inch agricultural tile, pierced the covering of sand, and communicated with the upper layer of broken stone beneath it. This tank had no diaphragm. The effluent from the strainers entered at its top, trickled down over the broken stone and gravel, and ran out at the bottom through the pipe *R*, which discharged into an upright length of vitrified pipe *S*, closed at one end, effectually trapping the outlet, and preventing air from escaping with the effluent. This trap overflowed into a rectangular wooden tank of about 350 gallons capacity, sunk in the ground, which collected the effluent and allowed convenient inspection of it in bulk."

In the aerating tank the forced aeration was constant. Air was delivered at its bottom, and rose through the gravel to the upper layer of broken stone, and thence escaped, by means of the vent pipes, to the outer air."

The liquid which was constantly trickling down in thin films over the surfaces of the broken stone and gravel was always in immediate contact with a current of fresh air passing in an opposite direction through the voids between the particles of stone.

When the sewage was first applied, it sank through the layer of sand within a few inches of the point at which it was delivered and passed quickly through the tank, showing little or no improvement as it escaped. Gradually, however, the surface of the sand became partially clogged and the sewage was distributed over a wider area, until at length the whole surface of the tank was covered with liquid two or three inches deep. This secured uniformity of distribution throughout the tank. Gradually, also, the organisms of nitrification began to multiply and to seize upon the dissolved impurities, destroying their organic character and transforming them into nitrites and nitrates, in which un-objectionable mineral form they escaped with the effluent. The first signs of this action were shown on June 12th. Once started, it increased rapidly, and by June 27th the average working rate of nitrification was reached. From this time to the end of the experiment the operation of this tank was practically constant, occasionally influenced by changed conditions, as is shown in the tables of analyses, but quickly adjusting itself to these conditions.

In a strainer, during its periods of use, the voids of the material were completely filled by the flow of sewage. In an aerator the voids were mainly filled by a constantly moving current of air, the liquid passing down, not in bulk, but in thin films, which worked their way over the surfaces of the particles of gravel or coke. The capacity of an aerator was, therefore, much less than that of a strainer of the same size.

The general arrangement with the straining apron, a group of four straining tanks, and one aerating tank, is shown in Fig. 5.

The average daily flow through the strainer was at the rate of 3,787,200 gallons per acre; the maximum was 8,950,194 gallons; and through the aerators at the rate of 1,064,213 gallons, the maximum, after nitrification began, being 4,826,112 gallons.

The table in the Appendix shows that the average percentage of purification, as represented by the removal of organic nitrogenous matter, accomplished by the strainers alone, was 51·2; and by the strainers and aerators together, 92·5. At one time a purification of 99·08 per cent. was reached.

The sole function of the forced aeration was to supply oxygen to the interior of the tanks in sufficient quantity to excite and maintain the maximum activity of the bacteria of decomposition; although the presence of oxygen is necessary for constant purification, no benefit is derived from the supply of an excess. Towards the close of the experiment, the air-pipe was closed and a ⅜-inch hole opened, reducing the supply, theoretically, by three-fourths. The tank was operated with this amount of air until the close of the experiment. The effluent showed no signs of deterioration, and the supply appeared to be ample.

Colonel Waring observes that probably a vigorous aerating of the filter for, say five minutes in each hour, thoroughly changing the air in all its voids, would store sufficient oxygen to keep the bacteria active until the next period of aeration. This course would probably be wiser than an attempt to furnish a constant supply at a lower pressure, for, in the latter case, the more remote or compact portions of the filter might not be penetrated by it; while intermittent aeration at a higher pressure would force the air into every crack or corner, and secure the efficient operation of all parts of the mass. By means of light partition walls or diaphragms the filtering material could be divided into sections, which could be aerated vigorously in turn. Assuming that the above suggestion of five minutes aeration in each hour should prove practical, the entire filter could thus be satisfactorily operated with one-twelfth of the air and power which would be used if the aeration were constant.

When the station was dismantled and the tanks taken apart

APPENDIX.

Summary of results obtained by Colonel G. E. Waring, Junr., M.Inst.C.E., at Newport, Rhode Island, U.S.A.

All the figures are corrected for loss due to draining the straining tanks before aeration.

The percentage of purification is estimated from ammonia figures, and represents—

1. In column marked **A** the percentage of nitrogen removed from the *sewage* after passing through the straining tank.
2. In column marked **B** the further percentage of nitrogen removed from the *effluent* after passing through the aerating tank.

The first, therefore, is a measure of the purification of the original sewage on leaving the straining tank. The second set of percentages is a measure of the further purification of the effluent by the aerating tank.

TANK NO. 1 STRAINER.

Filtering surface $\frac{1}{1980}$ of an acre. Filled with coarse broken stone. Voids of stones after drainage = 43 per cent. Capacity for sewage 450 gallons, being allowance for drainage.

TANK NO. 2 STRAINER.

Filled with fine crushed stone. Filtering surface $\frac{1}{1980}$ of an acre. Capacity for sewage 450 gallons, being allowance for drainage. Voids of stones after draining = 44·1 per cent.

TANK NO. 3 STRAINER.

Filled with coarse beach gravel. Filtering material surface $\frac{1}{1980}$ of an acre. Capacity for sewage 350 gallons, being allowance for draining. Voids of gravel after draining = 32·1 per cent.

TANK NO. 4 STRAINER.

Filled with fine beach gravel. Filtering surface $\frac{1}{1980}$ of an acre. Capacity for sewage 350 gallons, being allowance for draining. Voids of gravel after draining = 34·4 per cent.

TANK No. 5 AERATOR.

Filled with fine beach gravel. Filtering surface $\frac{1}{1920}$ of an acre. Voids of gravel after draining = 34·4 per cent.

TANK No. 1 AERATOR.

Filled with coke (screening half). Filtering surface $\frac{1}{1910}$ of an acre. Voids of coke = 38·9 per cent.

Tank.	Total Days Pumping.	Total Gallons Pumped.	Average per cent. of time Pumping.	Average Air Pressure inches of Water.	Total Gallons per Acre.	Daily Average Rate.	Total Days Aeration.	Average of Purification. A	Average of Purification. B
			Aver.	Aver.					
1	26	54,449·5	77·2	1⅛	107,810·000	4,147·000	37	49·2	49·2
2	71	129,039·7	63·2	1¼	255,599·000	3,045·000	69	46·3	38·5
3	88	159,345·5	75·1	1¼	315,543·000	3,584·000	61	53·0	36·8
4	71	130,817·7	77·1	1¾	258,917·000	3,646·000	78	56·2	24·5
5	138	76,110·7	71·1	2⅛	146,178·000	1,060·000	148	90·3	77·2
1	67	34,097·8	78·2	2½	65,124·000	972·000	65	94·7	90·8

Prof. W. H. CORFIELD (London) regarded the experiments made by the Massachusetts Board of Health as very largely confirmatory of our English experiments in the filtration of sewage and its application to land. The experiments of Frankland and the practical results obtained by Bailey Denton and Baldwin Latham taught that the use of sand and gravel was quite effective as a filtering medium for sewage if properly applied. The experiments made in sewage filtration and published by the Sewage Committee of the British Association showed that filtration was as effective in Winter as in Summer. The Massachusetts experiments were valuable chiefly as affording confirmatory proof of our previous experience. The experiments referred to in Sir Douglas Galton's paper further evidenced the fact that filtration was even in Winter far more effective than chemical precipitation, and also that acid sewage could be treated if a layer of limestone were placed in the upper part of the filtering media. In water filtration it was shown that the results were more satisfactory if the scum which gradually formed on the top of the filter was allowed to remain, but the Massachusetts experiments showed that the scum formed by sewage on land should be systematically broken up. Here no new fact was brought to light, for it was well known to the sewage farmer that the results of ground enriched by sewage manure were better if the surface of the land treated was broken up.

Mr. S. R. LOWCOCK (Birmingham) agreed that the principles on which the Massachusetts experiments were based were perfectly well known in this country, and what they had done was to demonstrate practically that these principles were correct, and they were therefore most valuable. The theory of sewage treatment whether on land or by means of special filters is exactly the same, and the failures in sewage purification which not infrequently occur are due to neglect of the principles on which this theory is based. The error of those people who say that the engineer of to-day knows nothing (or very little) about sewage treatment is due to the fact that such persons know nothing of the extensive literature of sewage treatment which now exists, and do not read up or in other ways do not make themselves acquainted with the real facts. He was very pleased to know that in America Col. Waring had obtained similiar results to those he himself had obtained in this country, the only practical difference between Col. Waring's system and his own being in the method by which the filtering medium was aerated. If Col. Waring's straining tank were superimposed upon the aerating tank the arrangement would be almost identical with his own, but the aeration would be from the bottom upward to the middle layer, whereas in his own it was downward from the middle layer to the bottom. He quite endorsed the conclusions as to the clearing of the straining material, as he had found that the surface sand removed from his filters and merely turned over in the presence of air in the course of a very few days became perfectly clean and could be re-used. In comparing the results obtained by various systems, not only as between America and this country, but in different towns and districts in the same country, due consideration must be given to the different characteristics and strengths of the sewage treated, as these differences control the qualities which can be dealt with on any given area, and the measure of purification which can be obtained. His own experiments showed this very clearly; at Malvern Link, where the sewage is of a purely domestic character, he had obtained a purification of over 99 per cent. from the tank effluent to the filtrate, while at Wolverhampton with exactly similar arrangements the purification, calculated on the same basis, so far has only reached 85 per cent. This is entirely due to the character of the sewage, which is quite abnormal and extremely difficult to treat. There are a large number of galvanizing and other works in the district, and in spite of vigilance on the part of the Authorities large quantities of acid waste are discharged into the sewers, or, when the waste is treated at the works quantities of chloride of calcium are discharged. The result is shown in the following table by the unusually high amount of chlorine.

No.	TANK EFFLUENT.					FILTER EFFLUENT.					REDUCTION PER CENT.		
	Free Ammonia.	Albuminoid Ammonia.	Nitrates and Nitrites.	Oxygen.	Chlorine.	Free Ammonia.	Albuminoid Ammonia.	Nitrates and Nitrites.	Oxygen.	Chlorine.	Free Ammonia.	Albuminoid Ammonia	Oxygen Consumed.
1	6·7	·40	Traces	2·5	17·8	4·0	·20	·50	1·5	17·0	40·0	50	40
2	4·0	·70	Traces	3·5	14·0	2·8	·20	·45	1·7	14·0	30·0	71	51
3	6·0	·70	Nil ...	5·3	22·4	1·6	·25	2·40	1·9	21·5	73·0	64	64
4	6·0	·60	Traces	1·9	24·5	1·4	·30	2·56	·6	24·4	75·6	50	68
5	6·6	·60	Traces	1·4	26·7	1·6	·30	2·56	·4	26·6	76·0	50	71
6	4·0	·35	Traces	1·7	14·0	1·2	·07	2·68	·4	16·8	70·0	80	77
	Parts per 100,000.				Grains per Gallon	Parts per 100,000.				Grains per Gallon			

The Table shows a set of twelve analyses, six of tank effluent, and the corresponding six of filtrate, taken at various periods extending over twelve months, during which time the filter has been continuously at work. These samples are an average of twelve hours' flow in each case. The filter was started in October, 1894, and the first pair of samples were taken a month afterwards, and the others at intervals until the last were taken on October 8th, 1895. The rate of flow was 1,000,000 gallons per acre when samples four and five were taken, and 500,000 gallons when the other samples were taken. The analyses are interesting as showing the effect of the chlorides on the purification, as, although throughout the whole series the results, as judged by the oxygen consumed and the large increase in the nitrates, show continuous improvement; yet where the chlorine is high there appears to have been a retarding action which prevented the breaking down of the albuminoid ammonia, or combined it in some stable form, the nitrification reducing the free ammonia in larger proportions, while when the chlorides are lower the albuminoid ammonia is reduced in larger proportions. The nitrifying organisms are evidently very active, and this is further proved by the fact that none of the samples of filtrate have undergone putrefaction, but have almost uniformly developed a green growth. His own experience agreed with that of the Massachusetts experimenters and Col. Waring, that a very small quantity of air is sufficient, and that nothing is gained by an excess, and that where the aeration is sufficient very complete purification of the sewage is effected, and the filtering media are kept perfectly sweet and clean for apparently an indefinite period.

Mr. SCOTT-MONCRIEFF (London) said that when he commenced his experiments the reports of the Massachusetts Board of Health were not make known. As a matter of fact the first biological filter bed ever used in England had been constructed by him at his own house and practically applied in July, 1892, and since then many others had been adopted. His investigations had been carried out upon lines which differed greatly from those referred to in the paper and he had no doubt but that the subject, in the course of a few years, would be discussed in a way that at present was not possible. The knowledge of the habits and methods of the organisms which carried on the work of putrefaction and purification, outside of the laboratory, was at present of a most meagre kind, the attention of bacteriologists having been almost exclusively devoted to the study of organisms in relation to disease. Referring to the diagrams, he said, that in the case of Col. Waring's upward "strainer" no doubt a considerable breaking up of the organic matter occurred, but it was a mistake to suppose that any large provision of air was required for this most important part of the general process. There were reasons for believing that the work of liquefaction was carried on first by aerobic organisms which so completely exhaust the oxygen contained in sewage that it becomes possible for anaerobic organisms, which are equally active, to finish the process. Their combined operations would besides other products yield a large amount of free ammonia, the presence of which in the effluent is always a proof of the activity of the organisms. Again, referring to the diagrams he said, that the downward filters of Col. Waring and Mr. Lowcock with special provision for mechanical aeration would probably be found to be applicable to the final mineralisation of the organic matter by the special organisms of nitrification. Certainly such appliances as had been described did not represent anything approaching to the full process of conversion from the organic to the inorganic state. For instance, any apparatus which provided for the deposition and removal of the organic sludge previous to the bacteriological treatment of sewage, as shown in Mr. Lowcock's diagram, was obviously defective inasmuch as it deprived the organisms of the food which it was their function to liquefy and mineralise, completing the cycle of nature from the effete products of animals to the nourishment of growing plants. He had no doubt that this process to which he had given the name of "biolysis," would before long be looked upon, on its practical side, as a most important branch of the science of Bacteriology.

Dr. S. Rideal (London) said although the experiments of Col. Waring were new to him, yet they confirmed the results of those already published by the Massachusetts Board of Health, and by Mr. Dibdin, of the London County Council, whose work, judging by the report issued by the Main Drainage Committee in the summer, seemed to be very far ahead of the Massachusetts experiments. The terms "filter" and "filtration," as applied to these methods for purifying sewage are not happy ones, as these terms are now better restricted, as Dr. Down has himself pointed out, to the removal of bacteria as well as of suspended matter from liquids; and he thought it would be better if the words "strainer" and "aerator" were used in describing such apparatus. Nitrification is a word very often used in connection with these matters, but is often misused so as to be almost equivalent to the term purification. Nitrification is the term given to the conversion of ammonia into nitrous and nitric acids by organisms, and ought not to be applied to the breaking down of the organic nitrogenous matter into ammonia. There were some twenty or thirty organisms known to bring about nitrification, and some or all of these live and move and have their being in the aerators, but they were totally distinct from the organisms which had the effect of breaking down the original matter in the strainer. The initial process might be called hydrolysis, or the resolution of the complex organic compounds into simpler ones, without the addition of oxygen from the air. This breaking down of the solid fœces does not take place readily under ordinary circumstances, owing to the fact that it contains compounds like indole and skatole, which are antiseptic in their action, and which are secreted during the process of digestion in sufficient quantity to bring that process to a standstill. An analysis of fœcal matter shows that it consists of a considerable quantity of undigested food, in addition to cellulose and woody fibres which are not easily digested by man. The natural enzymes of the human system, or adventitious bacteria, would complete this digestion and render a large portion of the solid fœces quickly soluble if the antiseptic compounds were removed. Dilution with water in sewers and cesspools, and still better in these straining tanks, will remove these antiseptics and permit of further digestion. Even cellulose, paper and straw can similarly be rendered soluble by organisms provided no retarding antiseptics are present; and these newer processes of preliminary sewage treatment, as distinguished from precipitation, seem to be capable of explanation on these lines, the final conversion of the ammonia and ammonium compounds into nitrates being effected in the aerators or so-called coke-breeze filters.

Mr. A. R. BINNIE (Chief Engineer to the London County Council) said that he had been engaged for some years in studying how to dispose of 180,000,000 gallons of crude sewage per day, and that by the method of precipitation adopted 2,000,000 tons of sludge, containing about 200,000 tons of absolutely dry solid matter, are abstracted from this crude sewage and sent to sea every year. There were still, however, three to six grains of solid sewage matter per gallon in the effluent, and he, in conjunction with the Chemist to the Council, had tried experiments with a view to discovering the best mode of removing these, as well as a portion of the dissolved organic matter. In filters of the general description the water stood at two, three, to five feet above the filtering materials, which latter hardly ever got any aeration whatever. They were told that impurities consisted largely of organic matter, and that oxygen was necessary to effectually obviate its harmful effects. Sir Joseph Bazalgette had tried the experiment of oxygenising sewage by atmospheric air, but the effect of it had very little value, and the result of experiments had shown that it was necessary to bring the sewage into contact with the air under peculiar circumstances. As an engineer he had heard of nitrifying organisms, and enquiries to his bacteriological friends elicited the fact that these organisms were of peculiar habit and could not be cultivated in the ordinary media. The experiments of himself and the Chemist to the Council were directed to finding out the best means of dealing with the effluent of the sewage, and after nine months' work they had come to the conclusion that filtration through coke was the best. The filter was composed of ordinary drain tiles covered with coke, and six inches of sand, the latter not for filtration purposes, but to keep the coke from floating at the top of the tank. The filter was filled and allowed to stand for a few hours, the water being then drawn off. In doing this a vacuum was created, and by atmospheric pressure the whole of the medium was thoroughly and rapidly aerated. The effluent after this treatment was absolutely unimpeachable, being clear and free from smell. But in observing the outlet drains it was at once apparent that the work was not complete. Nature was at work still, and the drains were a beautiful sight, being almost entirely coated with Vorticilla; yet the Engineer and the Chemist could and did by various processes remove the dead and effete matter, and render the effluent exceedingly pure.

The general result of his experience was that he did not think that any system of filtration, however perfect, would remove and get rid of the 2,000,000 tons of sludge, or the 200,000 tons of dry solid matter; and although the filters no doubt marvellously improved the effluent from the precipitation channels, yet he feared that even the filters themselves would require to be cleansed, as among the two to six grains of solid matter in suspension in the effluent, there was a certain amount of mineral matter which deposits itself as sticky mud on the upper or sand surface of the filter.

Mr. W. C. SILLAR (London) contended that considering the prominence now given to agricultural distress, the utilization of the manurial wealth contained in town sewage should be taken in conjunction with the subject under discussion which, judging from the terms of the paper read, seemed confined to its destruction merely. It was now no longer a matter of theory but of admitted fact that town sewage can be so treated as to preserve this manurial wealth, and Sir Douglas Galton knows this, as he has himself used it on his farm for several years in succession.

THE INFLUENCE OF SUBSOIL-WATER ON HEALTH.

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When requested to open a discussion on the Influence of the Subsoil-Water on Health, I felt that it would be ungracious to refuse the invitation, seeing that when writing on this question some time ago, I had taken the opportunity of making myself as fully acquainted as possible with the literature of the subject. At the same time, however, I think it only right to state that it is unfortunately not within my power to lay before you anything of an original nature, for the reason that I have had, I regret to say, neither the time nor opportunity of carrying out research work in this direction.

Still it may possibly be open to question as to whether this very fact is altogether a disadvantage in the case of the opener of a discussion, who will, for this reason, perhaps, be likely to take a more thoroughly wide and impartial view of the matters under consideration than is altogether possible to a worker who has devoted his energies to the elucidation of one particular section of a subject, which under these circumstances, as I know from my own experience, is liable to appear of greater relative importance than by other persons may be considered to be quite justifiable.

Just as the drill sergeant "sizes" his men and ranges them in line for inspection by his superior officer, so, as it appears to me, a useful purpose may be served by a marshalling of the various theories, facts, and I might almost add, fancies, which from time to time have been advanced by observers who have carried out investigations relating to the subject matter under discussion; at the same time indicating, as far as may be in my power, the various points which either have as yet not received their due share of attention, or concerning which at present it has not been possible to arrive at any satisfactory conclusions.

To Pettenkofer is due the credit of having been the first to direct attention, by his important investigations, to the subject of the subsoil-water in its relation to disease. In this connection it is necessary to distinguish between the amount of water mixed with air which is present in the interstices of the soil, known as "moisture," and the continuous subterranean lake or sheet of water found in most soils at varying depths from the surface, known as "ground-water." Pettenkofer defines this ground-water as that condition in which all interstices are filled with water, so that, except in so far as its particles are separated by solid portions of soil, there is a continuity of water.

The amount of "moisture in the soil" depends on its power of absorbing and retaining water, supplied by the rainfall, or derived from the ground-water below. It would appear that wetting of the soil, when due to a rise of ground-water, will conduce to active putrefaction in the deep layers, while the superficial layers remaining permeable, the products of decomposition can readily make their way to the surface of the earth, whereas when the wetting of the soil is due to the rainfall the conditions will be different.

This continuous sheet of water, termed "ground-water," is found below the surface of the soil, at depths which vary very considerably in different localities, as occasionally it may reach to within a few inches of the surface, while in other cases it may only be met with at a hundred or more feet below it. This difference in level will depend on the permeability of the soil, on the nature and inclination of the strata below the surface, whether loose or compact, and on the ease or the reverse with which the water can flow away to some outlet in springs, rivers, or the sea. The water is in constant movement in its endeavour to reach such outlets, and the variations in the level of the ground-water caused by such flow is best studied by taking measurements of the level of water in wells, as has been done in a most exhaustive manner by Pettenkofer, Fodor, Baldwin Latham, Adams, and others, who have insisted strongly on the importance of such variations of level of the ground-water, as constituting a weighty factor in the etiology of certain diseases, especially cholera, enteric fever, and diphtheria.

Fodor found that at Buda-Pesth such variations were regulated over the greater part of the city by the varying level of the Danube, the greatest fluctuations being found in the wells nearer the river; while on the other hand, the greater the distance from the Danube the smaller were the variations of the water level, until at the outer limits of the city they almost entirely disappeared.

Although the level of the ground-water is thus constantly changing, the difference between its highest and lowest levels is usually not more than a few feet, while in some instances the range of movement may be only a few inches either way. At Munich a difference of ten feet has been noticed, and in India it is often much more than this, a range of 42¼ ft. having been recorded. Fodor noted seasonal variations of the ground-water level which, however, agreed very closely with variations in the level of the Danube; the ground-water and that of the river rising and falling, and reaching their maximum and minimum at the same time. It must not, however, be supposed that the rainfall never affects the ground-water, as in some instances it undoubtedly does so; but even then the effect may not be visible until some considerable time afterwards, extending to weeks or even months. On the other hand, in low-lying situations, such as in plains at the foot of hills, the level may be raised by rainfalls occurring at far distant spots. The level will also be raised by any obstruction at the outfall, such as may be caused by the silting up of a watercourse or the backward pressure of the sea, and on the other hand, it will be lowered by any removal of obstruction, such as may be secured by skilful drainage. The ground-water is constantly moving in a horizontal direction, usually flowing towards the nearest watercourse or the sea; the rate of movement depending on the inclination of underlying impervious strata, and the ease, or the reverse, with which it can eventually escape, so that it varies greatly in different places. Its rate of movement is also influenced by the roots of trees, as when trees are removed it runs off much more rapidly.

The height to which the ground-water extends is measured by noting the level of water in wells in the locality in which the investigation is to be carried out. For this purpose, Pettenkofer recommends that a rod or rope, to which a number of small cups are fixed at equal distances, should be lowered into the well. On drawing them up again, the highest one which contains water will obviously denote fairly accurately the height at which water stands in that particular well, and if the length of rod which has been lowered is noted, the distance from the surface to the water-level will be found.

Another method, given by Pettenkofer for the determination of the level of well-water, consists in the use of a large float, suspended by a chain passing over a pulley, which is connected with a counter-balance having an indicator attached to it, which marks the height on a fixed scale which has been previously experimentally graduated for the length of the chain.

Mr. Adams, who for some years past has kept careful record of the variations in the level of the subsoil-water at Maidstone, informs me that his estimations are made by means of a float and tell-tale communicating with a well some 17 feet deep, situated in the rock (Kentish rag) closed against all other use, and situated beyond the range of disturbance that might arise from pumping in the neighbourhood. He adds that the mechanism of his tell-tale is very simple, and that from time to time the accuracy of the measurement has been verified.

It ought not to be difficult to devise a mechanism for taking a continuous and automatic record, and it is obvious that the use of such an apparatus would save an infinity of time and trouble.

To arrive at any correct estimate of the true ground-water level, a large number of experiments should be carried out simultaneously in the wells over a considerable area, so as to obviate sources of error arising from local conditions. To be of any real use, such observations should be made as frequently as possible; those from which Fodor arrives at his conclusions having been made every week in a large number of adjoining places, the series extending over a period of several years. Adams takes his observations daily, as a matter of routine, but from a single well only.

In all probability the variations in incidence of those diseases, chiefly of the zymotic type, which there appears reason for believing to have some relation to fluctuations in level of the ground water, are really more dependent on certain other factors, more particularly movements of the subsoil-air, leading in turn to contamination of the atmosphere, or of the drinking-water, by specific micro-organisms which are carried in various directions by the currents of ground-air. As, however, these currents are, in large measure, regulated by variations in the level of the subsoil-water, special attention has been directed to this factor, which admits of more ready estimation, and which has, I think, for this reason been accorded a somewhat greater importance than really attaches to it.

Accordingly, in reviewing the similarity or the reverse which at any given time or place may be found to exist between the recorded variations of ground-water level and the attack or mortality rate of any given disease, we must be on our guard against becoming oblivious to the possibility of the concurrent action of other causes which, though not admitting of so easy or so accurate investigation, may none the less possess an influence which it is important not to overlook.

Bearing in mind such reservation, we may now proceed to discuss the evidence which at the present time is available as to the relationship between disease incidence and variations in the level of the subsoil-water. And in this connection we naturally first turn to the consideration of such specific infections as cholera and typhoid or enteric fever, which are generally considered as typically water-borne diseases.

CHOLERA.

As regards cholera, Pettenkofer and other observers in Germany have maintained that its diffusion is mainly due to movements of the subsoil-water, the fundamental proposition being that cholera never prevails epidemically where the soil is impermeable to water, or where the level of the ground-water is not liable to fluctuations.

According to Pettenkofer, the condition of soil with which cholera is most apt to prevail is that which occurs when the ground-water, after having attained a higher level than usual, commences again to fall. It is conceivable that an outbreak might be caused in this way by noxious organic material being washed into wells to which it could not ordinarily gain access; or again, it might be due to micro-organisms, present in the upper layers of the soil, which had been awakened into activity by the combined influence of heat and moisture, becoming diffused into the atmosphere when the superficial stratum of the earth again became comparatively dry.

As these views have apparently met with but little acceptance in England, it may be worth while to mention a curious fact quoted by Fagge in connection with the East London epidemic of 1866, which appears to be strongly in favour of Pettenkofer's theory. In a school at Limehouse were 400 children, not one of whom was attacked with cholera or with diarrhœa. Now, the school had its whole water supply from the Old Ford reservoirs, by which it had been thought the disease was spread, and the children at all times made free use of the water. A special investigation of the soil beneath this school brought to light the fact that it stood upon a thick layer of fine brick earth, and not of gravel, as appeared to be the case with the streets immediately adjacent.

It should, of course, be remembered that Pettenkofer admits the necessity for the presence of a specific germ, which, however, is only able to assert itself in a virulent manner when its environment is suitable, so that the state of the soil is really a predisposing cause. Nägeli, a supporter of Pettenkofer, further suggests that the soil gives off certain microzymes which must be present in the body of everyone who is to afford favourable conditions for the development of another set of microzymes derived from a pre-existing case of cholera, which would, however, probably be too few to be able to overcome the resistance of the living tissues, unless these latter had first been weakened by the previous invasion of organisms peculiar to the soil.

The researches of Lewis and Cunningham at Calcutta seem to prove that in that place the ground-water level, and in a less marked degree, the rainfall, bear an inverse relation to the prevalence of the disease. When the latter is at a maximum the water level is at a minimum, and when the water level is at a maximum the prevalence of the cholera is at a minimum.

There is, however, no correspondence as between one year and another or one month and another, or in other words, the absolute height of the subsoil-water is by itself of no significance for the amount of sickness.

Still, they call attention to the fact that the two years 1871 and 1872 in their eight years' period, which had the minimum number of cholera cases, were distinguished by the remarkably high level of the subsoil-water.

Hirsch makes a great point of the statement that it is always an essential circumstance that the soil be saturated with moisture, but only to that degree at which it is still pervious to air, and that the organic matters accumulated in it should undergo decomposition, under the influence of somewhat high temperatures. Consequently the question is not as to the extent of the stratum of soil saturated with moisture and permeable to air, or in other words, a question of the higher or lower level of the subsoil-water, but it is a question whether such a stratum exists at all, and that is, in his opinion, the gist of the much quoted and much misunderstood doctrine of Pettenkofer as to the significance of the height and fluctuations of the subsoil-water in the production and diffusion of cholera.

This conception of the part played by variations in the amount of water in the soil is indeed upheld by Pettenkofer himself, who, writing in 1870, says, "In my view, the level of the subsoil-water reveals nothing more than this, viz., the limits of a certain degree of humidity in a porous stratum of soil, or the limits within which the pores are kept constantly full of water and all the air driven out of them. Between that degree of humidity and absolute dryness of the porous stratum, there are all those gradations when the pores are filled in part with air and in part with water in varying proportions which we include altogether under the terms 'moist' or 'wet.' The point at which the pores are completely closed by water, is one that may be observed with ease and certainty, and I have therefore chosen the level of the subsoil-water merely as an easily seen gauge and index of certain states of humidity in the stratum of porous and permeable soil which overlies the subsoil-water, an index, viz., of the fluctuations in the state of humidity within a given period, and of the time that any one degree has lasted.

"Whether that index is a few feet nearer to or farther from the surface does not affect the value of its revelations. For the importance of the index lies in this; that it declares the changes in the humidity of the overlying strata, by means of the natural effects of those changes. The fluctuations in the level of the subsoil-water have a meaning for etiology, only because they are traced back to those primary influences by which air and water are made to share in varying proportion the possession of the pores of an impregnated soil. Beyond that they have no significance . . . . looked at by itself and for its own sake, the condition of the subsoil-water has as little significance as the hands and dial of a watch dissociated in thought from the works to which they belong."

Typhoid.

Typhoid or enteric fever is another disease which has for a considerable time past been believed by observers in different parts of the world to have some causal relationship with varying levels of the subsoil-water. Thus, although no pronounced relation could be found between the death-rate and the temperature or putrefactive activity of the soil, Fodor has demonstrated an apparent close connection between the typhoid curve and one representing variations in the level of the Danube, both these curves, almost without exception, rising and falling together. Thus at the beginning of 1872 both of these curves rose simultaneously, attained their acme in the middle of the year, and then both fell off in a like manner. In this connection it must be remembered that the level of the Danube exerts a very regular influence on the ground-water level throughout the greater part of the town, and thus it would appear that in Buda-Pesth typhoid is most commonly related to a rising level of the water in the soil. In Munich, where Buhl applied the observations of Pettenkofer on cholera to the incidence of typhoid, and in Berlin, on the other hand, the reverse phenomenon has been recorded, the disease in both places increasing as the ground-water falls. This latter state of things has been referred to a more active decomposition of organic material in the more superficial and polluted layers of the soil, following on the abstraction of a certain amount of water from the earth, and possibly this explanation may be correct as regards Berlin, where outbreaks most commonly occur in the Autumn. In Buda-Pesth, however, as already stated, the disease is usually more prevalent in winter and spring, and seeing that there is often so close a connection of epidemic enteric fever with variations in level of the ground-water, we may, perhaps, infer that it is there influenced to a certain extent by processes going on in the deeper layers of the soil, those layers, indeed, in which the rise or fall of the ground-water is felt.

Liebermeister and Buchanan, with considerable reason, have supposed that subsoil-water observations simply illustrate the communication of the disease by means of drinking-water, the water of surface wells being generally more impure when the level of the subsoil-water is persistently low; when also there will be more likelihood of noxious matter accumulating in the stagnant water in the soil.

Baldwin Latham states that in this country the disease is most prevalent after a dry period, when the first wetting of the ground, or percolation from any cause, takes place; and again, that typhoid fever is always more rife while the waters are rising in the ground than when they begin to diminish. And in this connection he refers to Dr. Buchanan's report on an outbreak of typhoid at Croydon in 1875, from which it appears that the outbreak, which attained considerable intensity in April of that year—a most unusual period—occurred almost coincidently with a rise of the ground-water, which rise had been delayed to a much later period than usual.

Again, in a report by Dr. Thorne Thorne, relating to an outbreak at the village of Terling in 1867-68, and involving no less than 208 persons out of a total population of 900, it is mentioned that all the wells in the village had become dry previous to the outbreak of fever, and the disease made its appearance at a time corresponding to the first replenishment of the water in these wells.

In the annual report of the Michigan State Board of Health for 1884, Dr. Baker, as the result of a long series of observations, concludes that, in Michigan at least, the prevalence of typhoid shows a very close relation to the height of water in wells, the disease increasing in inverse proportion to the height of the ground-water.

This relationship he found to be most marked in the second half of the year, the two curves of height of earth above water and of typhoid incidence following the one on the other with only such small delay in the typhoid curve as may, he thinks, be fully accounted for by the period of incubation. In the first half of the year, however, a difference is observed according as whether the surface of the earth is frozen or not. Thus he says, "with the advent of colder weather there is a rise in the water level which is uniformly followed by a decreased prevalence of fever; this decrease continues through the winter and spring even though the level of the well-water is lowered, provided the surface of the earth is deeply frozen. On the contrary, high water level in wells in winter and spring coincident with ground not thoroughly frozen, is followed by prevalence of the fever."

Dr. Baker agrees then with Pettenkofer's view that there is a causal relation of low ground-water and increase of typhoid fever, but unlike the latter investigator, he puts a somewhat different interpretation on the observed facts, in believing that the cause of the fever most frequently enters the body through the medium of the drinking-water.

DIPHTHERIA.

It is owing to the labours of English observers that we possess any knowledge as to the probable connection between diphtheria incidence and local conditions of the soil and soil-water.

In a series of papers contributed to the "Lancet" in 1878, Dr. Thursfield gave expression to his opinion that diphtheria, at that time essentially a disease of rural districts otherwise the most healthy as indicated by the fever death-rate, was intimately connected as regards local conditions with structural dampness of habitation.

That structural dampness of dwellings is a most important factor in the development of diphtheria is now generally admitted, such a condition being most favourable for the incidence and severity of the affection and the persistent vitality of the germ of the disease.

As Dr. Thursfield has pointed out, this dampness of houses may depend on the subsoil-water being so close to the surface that the cellar always contains more or less water, or upon the house being built upon a retentive clay without the precaution having been taken of providing a damp-proof substratum, but even more frequently upon the house being deeply embedded at the back or slightly all round. Although dampness of site is undoubtedly a factor in the production of outbreaks of diphtheria, particularly if such dampness be due to persistent leakage from imperfect sewers or cesspools, it is only comparatively recently that we have obtained proof of any direct relation between the occurrence of an epidemic and a rise or fall of subsoil-water. Adams, by his researches carried out at Maidstone during the last ten years, has placed at our disposal a continuous series of observations of the range of movement of the ground-water, together with a concurrent record of the rainfall, barometric pressure, and incidence and mortality rate of diphtheria, which cannot fail to be of great value in the elucidation of this subject.

This series of observations are of more interest because when commenced in 1884, Mr. Adams had, as he states in a paper read at the Hygiene Congress held in London in 1891, no preconceived ideas as to the results which he expected to obtain from them, although, as he adds, the hope was always entertained that very probably something of a practical value in course of time might issue therefrom.

For the first three and a half years during which his daily observations were recorded, the district to which he is Medical Officer of Health was practically free from diphtheria, but at the beginning of 1888, what afterwards proved to have been a serious and prolonged epidemic of diphtheria first made its appearance, from which time to the present it has continued with occasional intermissions.

Mr. Adams in his Annual Report for 1889, and in later papers, calls attention to the fact that his records of subsoil-water fluctuation, for the first three years during which they were kept, show a striking similitude to one another, each of these three years having a well marked high tide during the cold season, and an equally well marked low tide during the hot season, the transitions moreover being gradual.

In contrast with this, during the four succeeding years 1888–92 the tides were almost completely lost, being replaced by irregular and often abrupt oscillations of an indefinite and limited character, often so altered in respect of time that high tides appeared when, as the result of the records of previous years, low tides were expected, and *vice versâ*.

Moreover, the range of movement of the subsoil-water, which was greatest in 1885, became very considerably reduced during the next four years, after which it again gradually expanded, although by this time the range was about a higher average level. Almost contemporaneous with the commencement of these remarkable variations from the apparent normal as previously established, an outbreak of diphtheria made its appearance, which with occasional slight exceptions showed during succeeding years, first a rise and later a fall in intensity after the cyclic fashion to which Dr. Whitelegge has recently called attention. Mr. Adams claims that his records show during the whole period over which they extend, a strict concordance between soil dampness and diphtheria on the one hand, and absence of diphtheria and soil dryness on the other hand, the disease reaching its acme of virulence when stagnation of the subsoil-water is most complete. He contends moreover that his observations further demonstrate the fact that the *quality* as well as the *quantity* of the disease varies in obedience to the circumstances concerning the subsoil-water, there being an agreement in the inverse ratio between the case mortality from diphtheria and the range of the movements of the subsoil-water.

I have entered somewhat fully into this matter for the reason that I believe Mr. Adams' work to form practically the only regular and long continued record of the movements of the subsoil-water which has, as yet, been attempted in England, and as such it deserves the careful attention of all interested in public health work.

Mr. Baldwin Latham, in his address to the Royal Meteorological Society (1890), gives, as the condition which is essential to the development of diphtheria, a damp state of the ground, marked by extreme sensitiveness to percolation of rain, stating that the very opposite conditions are necessary for its development to those which occur with typhoid fever, although it follows the incidence of typhoid fever in parallel lines. In support of his contention, he states that for the whole of the five years immediately preceding the date of his paper, the ground at Croydon, where his investigations were carried out, had been in a continual state of dampness, as indicated by the records of his percolation gauges, and that during the whole of that period diphtheria had been more or less rife. These investigations, although carried out on somewhat different lines to those of Adams, tend rather to confirm them, as do also those of Buhl and Johr, who claim to have proved that an increase of mortality from this disease is closely connected with prevalent atmospheric conditions, the maximum mortality being in those places where there is throughout the year less equability of temperature and humidity of the air, since the lesser or greater humidity of the lower strata of the atmosphere depends in great measure on the dryness or the reverse of the upper layers of the soil.

PHTHISIS.

It is to the concurrent though entirely independent labours of Bowditch in America and of Buchanan in this country, that we owe the discovery of a connection between soil-dampness and the phthisis death-rate.

The Registrar-General for Scotland, in his Seventh Annual Report, referred to the fact that a similar relationship, as evidenced by the phthisis mortality statistics in Scotland, appeared to hold good for that country also.

The remarkable freedom from consumption of the Cape of Good Hope and South Africa generally, as also of Egypt, as compared with the relatively high mortality from it in the moist climate of Great Britain, is a fact which points in the same direction, and hence we may, I think, fairly consider the proposition affirming a close relation between tubercular disease and moisture of locality to be of practically universal application.

Appreciation of this relationship came about in the case of the late Sir George Buchanan's investigations from an inquiry undertaken by him in 1865-66, with the object of ascertaining what had been the results obtained by local authorities, who by means of such works as water-supply and sewerage, had attempted to improve the sanitary condition of the districts under their control. In many of these towns reported on, it was found that the laying of main sewers had brought about a permanent lowering of the subsoil-water, and that this had in turn been followed by diminution, more or less considerable, of phthisis, the reduction from the previous rate ranging, among the first fifteen towns, from 11 per cent. at Merthyr to 49 per cent. in Salisbury.

It will be seen that as regards this particular disease the question is not one merely of variations in the level of the ground-water so much as a considerable and permanent lowering of its level.

A certain amount of opposition has, however, been afforded to these views, notably by Dr. Charles Kelly, who, in his report for 1879, on the Combined Sanitary District of West Sussex, has thrown doubt on these conclusions, basing his statements on certain data collected within that rural area. He there states that, although the phthisis death-rate had been distinctly lowered during immediately preceding years, there had been no contemporary improvements in the system of drainage of the soil to account for the alteration. Dr. Thorne Thorne, on the other hand, has indicated that the large amount of agricultural drainage which had then already been effected throughout the Kingdom had been of a sort to produce a similar result in rural districts to that brought about by sanitary drainage in towns, and he at the same time calls attention to the fact that Dr. Kelly offers no explanation of the striking and definite relation shown by Buchanan to have existed between the amount of diminution of phthisis death-rate and the extent and permanence of the lowering of subsoil-water. In the same report Dr. Kelly states his belief that a number of changes, social as well as sanitary, including among them the improved state of the cottages, the rise of wages leading to the children being better clothed and fed, the increase in railway communication, which tends to diminish intermarriage of population, have all had their share in the undoubted improvement which has taken place.

In a later report (1887), Dr. Kelly again returns to the subject, and gives a series of comparison tables for the ten years —1876-86—relating to the combined district of West Sussex. He first classifies the different soils into three classes:

1. The pervious soils;
2. The retentive soils;
3. The moderately pervious soils;

and appends a table, showing the various death-rates on these different soils, the figures in which appear to show that the mortality from lung diseases varies considerably, being much higher on retentive than on porous soils; while the mortality from what is now registered as phthisis, and from all causes, is very nearly the same on each variety of soil. It should be remembered, however, that in this West Sussex district, as indeed throughout England, there has been a great reduction in the phthisis mortality since Buchanan's inquiry into the subject for the decade 1851-60.

Moreover, the assumption runs through all Dr. Kelly's arguments, that the *relative* wetness of soil in the six registration districts with which he is concerned remains in later times as it was in 1851-60.

What his statistics may be taken to show is that all the varieties of soil being now healthy, the cause of the phthisis deaths which still occur has to be sought for in some other direction.

Not a particle of evidence is adduced on this point, nor is the operation of sanitary measures upon the soil in the several districts even spoken of.

In his Sixth Annual Report (1879), indeed, it is stated that there has been "no change whatever in the drainage" of these rural districts, but this statement is too bald to be of much import. The assumption, too, pervades his argument that soil wetness is *the* cause of phthisis, whereas all that has ever been claimed for it in this connection is that it is *a* cause.

DIARRHŒA.

The researches of Ballard and of Tomkins have demonstrated the fact that a definite soil temperature plays an important part in the etiology of this disease. So clear indeed has such relationship of cause and effect been considered in many quarters, that those who are interested in sanitation are apt altogether to overlook the possibility of variations in the level of the subsoil-water playing some part in the matter.

It has, I think, been shown very definitely that the temperature of the atmosphere at any given time, itself plays no part in the series of events leading to an epidemic of diarrhœa, other than that comparatively slight influence which it exerts on the range of the subsoil temperature for the time being.

Thus Baldwin Latham has put on record the fact that while the average temperature of the air at Croydon in 1854 for the months of June, July, and August, was 59·4, and for the same months in the following year it was 61·1, yet in 1854 the deaths from diarrhœa were over five times as numerous as in 1855.

It is obvious that in the absence of some disturbing element, the temperature of the upper layers of the soil must be dependent on that of the atmosphere above, the only difference being that the maximum and minimum points are more and more delayed, and that the total range is gradually diminished as a greater distance from the surface is reached.

If, however, the soil be saturated with moisture, it will not heat as rapidly as if it were comparatively dry, and consequently an average atmospheric temperature, which when the soil is dry would be sufficient to bring up the soil temperature to that point which is necessary for the development and maturation of the germ of the disease, will by no means exert a similar influence when the soil is wet. In this way is propably to be found the explanation of Baldwin Latham's observation that diarrhœa is apt to be more prevalent when the subsoil-water is low. As I have endeavoured to show, however, this in no way militates against, but rather tends to support, the proposition so ably expounded by Ballard, to the effect that whatever the air temperature may be, diarrhœa does not appear in epidemic form until a definite temperature is reached at a given depth below the surface of the soil.

Snow has also shown that, in the city of Buffalo, cholera infantum is much more prevalent in a dry than in a wet season, and he suggests that this is probably due to the fact that in a dry season the temperature of the soil would be likely, other things being equal, to reach a higher point than in the opposite case.

This same fact has been insisted on by Fodor, who states, as the result of his experience, that an exceptional rainfall occurring in the midst of even the most violent epidemic, will be followed after from eight to ten days by a large reduction in the death-rate, but that on cessation of the rain the disease may assert itself afresh. The results of Power's investigations at Leicester are also in harmony with this statement.

Certain other diseases there are, which, at one time or another, have been deemed to depend on wetness of the soil for development of their full activity. Some however, such as malaria for instance, are fortunately at the present day practically unknown in this country, since the draining of the Fenlands was carried out, except when introduced from without; while in the case of others such as small-pox, scarlet fever, measles, whooping-cough, neuralgia and rheumatism, the evidence connecting their epidemicity with particular conditions of the subsoil-water is at present too scanty to permit of any trustworthy inference being drawn therefrom.

A survey of all the recorded work on the influence of subsoil-water on health appears then to show that rapid and abnormal oscillations of the level of the subsoil-water are particularly dangerous, such variations being of considerably greater importance than the actual distance of the ground-water from the surface. Other things being equal, it is doubtless true that the further the ground-water from the surface, the healthier will be the site, although in all probability a higher average level without obstruction to the outflow will not necessarily be more conducive to the appearance of disease, so long as the height is not such as to bring about more or less permanent dampness of dwellings.

As I have already stated, it would appear that with the exceptions, perhaps, of cholera and typhoid fever, the condition of the upper layer of the soil as regards the amount of moisture in its interstices is of more importance than the actual level of the ground-water beneath.

Nevertheless, observations of the variations of such level, will afford some index of the amount of moisture in the overlying-soil, although an almost equally important factor in the regulation of this condition must be sought in the extent of the rainfall.

There are, then, two different phases of subsoil-water variation, either of which is conceivably capable of bringing about such a state of soil moisture (short of saturation) as might be expected to aid in causing an increased multiplication of organisms in the soil. These are either :

(*a*) A sudden fall of ground-water after a rise; or

(*b*) A rise after a previous condition of low level,

particularly if happening at times when such phases do not ordinarily occur.

More especially will this be the case if at such period the temperature of the upper layers of the earth is high and the soil contains much material of an organic nature. In the light of Ballard's researches on diarrhœa we have reason for supposing that the optimum temperature for multiplication of pathogenic organisms in the soil obtains when the thermometer reaches somewhere about 56° F. at a distance of four feet from the surface.

It appears to me, therefore, that in order to fully elucidate the relationship of subsoil water to disease, it is in the first place highly desirable that an extended series of observations should be carried out simultaneously, at as great a number as possible, of stations in different parts of the country. In addition, concurrent observations should be made as far as was practicable of (1) the temperature of the soil, (2) of the organic matter present, and (3) of the amount of soil moisture; all these at depths of one foot and four feet from the surface respectively. Last, but by no means least, accurate record should be kept of the air temperature, of the barometric pressure, of rainfall and of frost, these last two factors having special importance in relation to distribution of soil-air currents into houses through the sealing of the surface of the ground.

It may be objected that my suggestions form a counsel of perfection which it would be impracticable to carry out in its entirety, but I am convinced that it is only by taking the utmost precaution to thoroughly check in every possible manner any series of scientific observations, that we can hope eventually to arrive at a true estimation of their value. Much undoubtedly has already been done, but much still remains to be done before what we now think we know can be considered to possess firm basis of fact.

In conclusion I desire to thank the Council for having afforded me the pleasant task of opening this evening's discussion, giving me thereby the opportunity of obtaining the benefit of such helpful criticism as the wider experience of many of those now present may suggest, to which I look forward as the result of this dicussion.

Dr. G. V. POORE (London) said he came to the meeting as a student rather than to take any part in the discussion, for the reason that it was only men like Dr. Copeman, from his position in the Local Government Board and Medical Officers of Health, who had opportunity of testing the facts in a variety of districts. It is impossible to refuse the facts given by such men as Pettenkofer and Baldwin Latham, and in the absence of any authenticated statements on the other side one would bow the head and accept them. He would like to call the attention of the meeting to Pettenkofer's statement that there was putrefactive matter in the soil. The question is how does this matter get into the water? If the disease is due to the rise or fall of water in the subsoil and the consequent release of disease germs they must find out how the bacilli got into the subsoil and then how to get rid of them. From his own experience he knew that there were substances which if buried would remain in a putrefactive state for a number of years, whilst peculiarities of the soil would arrest decay. Only the other day he was digging a small well in his own garden and under the turf came across a mass of leaves some three feet in depth; how long they had been buried there he had no idea, but he knew that the ground had not been disturbed for many years. Fœcal matter abounding in disease germs will exist if buried deeply as well as leaves, and such circumstances may occur anywhere. With regard to phthisis, Salisbury is an oft-quoted instance of how mortality from phthisis may be reduced by proper attention to drainage and other sanitary precautions. He had himself taken the trouble to enquire of some of the older inhabitants of Salisbury what had really happened, and he found that there were formerly canals running into the town, and the consequent dampness to the surrounding houses very great. When the drainage improvements were undertaken in Salisbury the deadheads to the old canals were removed and the water diverted into proper drains. Although phthisis is said to be due to subsoil water, he believed it was more largely brought about by direct infection consequent on overcrowding; whilst admitting that a person with confirmed tuberculosis is peculiarly sensitive to change in the temperature and to dampness, they must not confound death of the phthisical with the cause of tuberculosis. With regard to the temperature of the soil this was influenced by the sun's rays, and it was quite reasonable that if there is putrefaction in the soil and it became in any way dampened there might arise a putrefactive ferment and an accordingly increased temperature in the soil, for they knew that whenever matter was allowed to lay in a compact mass, there heat was set up. He had listened with deep interest to the paper by Dr. Copeman and had very great pleasure in moving a vote of thanks to him for bringing the subject forward.

Mr. R. F. **Grantham** (London), testified to the value of the paper just read. He had had experience in the drainage of land and the sewerage of towns, and at the International Congress of Hygiene, 1891, he had read a paper on the relations of drainage and irrigation to health, in the course of which he had quoted a Parliamentary report on the mortality of the French Army in Algeria. Colonel Ewart and Dr. Sutherland had found that the health of the troops had so improved when the subsoil-water was reduced twenty inches, that the death-rate had fallen from 57 per 1,000 to 24·8 per 1,000. From his experience in the Fens he had found that drainage had materially tended to the improvement of the general health of the people in those districts. He believed with Dr. Poore, however, that the prevalence of disease was not due merely to the presence of subsoil-water, but to the contamination of it by leakage from cesspools and badly laid drains, and its infiltration into wells. The investigations of Sir George Buchanan, Dr. Pettenkofer, and others, quoted in the paper, related rather to towns than to country places; still they gave very valuable data.

Dr. R. Dudfield (London) suggested that in addition to the dampness of sites of houses as favourable to the development of diphtheria might be added the fœcal pollution of the soil by unsound drainage. The rainfall was also he thought somehow connected with diphtheria. At Eastbourne he almost always observed an increase of this disease after a heavy rainfall. Such increase might be due to the change of level of the subsoil-water, and, he ventured to suggest, possibly to the dampness of the clothing of the children, who during the hours at school, were without opportunity of change, and they would remember that it is principally amongst school children that diphtheria chiefly prevailed. With reference to diarrhœa he would merely mention the fact that in 1893 he had to deal with an epidemic of infantile diarrhœa every case being carefully inquired into, with the result that something like 99 per cent (speaking from memory) of the cases were bottle-fed children, thus pointing in his opinion to the fact that this manner of feeding had something to do with the disease.

Dr. C. R. Drysdale (London) said the question of subsoil-water as connected with disease is a very interesting one. In the paper read four diseases were referred to in connection with subsoil-water. Notwithstanding the admirable researches of Buchanan and others in reference to phthisis, he would point out that London is far less liable to phthisis than it used to be. London is regularly and systematically drained, therefore the diminution of disease should be equal all over. But as a matter of fact there was twice as much consumption in St. Luke's as in Kensington. This was, he maintained, due very largely to overcrowding in the former place compared with the more comfortable quarters of Kensington. He felt somewhat sceptical as to the actual share that modern drainage works had in effecting the improvement. Pettenkofer had in Germany made great strides with regard to the method of dealing with cholera. This disease was, he thought, due rather to the state of the water supply; and the way in which England had got rid of the disease proved that we had a better knowledge of the matter than our continental neighbours. Enteric fever, too, he believed to be like cholera, an infectious disease, and the germs water-borne.

Dr. Louis Parkes (London) felt that the great lesson to be learned from the paper read that evening was not to jump too readily to conclusions. Dr. Copeman had given them a series of most interesting and carefully collected facts, yet he had avoided giving his own opinion. Probably, like others, he was not quite able to make up his mind. There was always a difficulty in distinguishing the cause from the antecedent of any disease, and in consequence it often happened that the conclusions arrived at as to the cause of an outbreak were erroneous. Epidemics of typhoid and kindred diseases were he believed due most often to impurity of the water supply. In the places mentioned where observations on subsoil-water had been made in connection with enteric fever mortality, the water supply was derived from shallow wells; but in no place where there was a public water supply could he remember that any outbreaks of disease had been attributed to movements of the ground water. Several causes tended to the modern greater prevalence of particular diseases, such as diphtheria. For instance, it might be that the susceptibilities of the children of to-day were different from those of forty or fifty years ago. Some diseases tended to die out and others to become more prominent. The people of forty years ago were perhaps not so susceptible to influenza as the present generation, especially to the neurotic forms of this complaint. He mentioned this to show that in dealing with increased prevalences of disease, something else besides local conditions had to be taken into account.

Dr. **Wilson Hake** (London) enquired whether any observations had been made concurrently with the rise and fall of subsoil-water in connection with the chemical and bacteriological condition of the water, as such a series of observations would probably supply much valuable information.

Mr. **Wolf Defries** (London) ventured to suggest that in addition to the bacteriological and chemical analyses of the water, it would be well to have similar examination of the air. Probably it would be worth while in connection with the bacteriological examination of the air to keep a record not only of temperature and of rainfall but also of humidity and of the sunshine. In the water examination precautions would have to be taken to prevent water, derived from leaky water-pipes or otherwise soaked down from the surface, from being mistaken for subsoil-water proper. It would also be desirable for observations to be made as to the bacterial as well as the chemical contents of the soils in question, and perhaps as to their capacity at different times for supporting or inhibiting the growth of particular organisms. Unless the conditions which are independently capable of producing the variations in health, which might be possibly due to variations in the level of the subsoil-water, were sufficiently plotted out, the number of observations to be made before one would have a result which could be regarded as at all trustworthy would be increased to such a degree as to render it almost impracticable. The additions suggested by the speaker certainly made, with those essential observations named by the author, a very long list. It would be observed, however, that they were almost all capable of being rapidly and simply made; and the speaker was afraid that, numerous as they were, they represented the least on which one could hope to found any definite proposition, and even with them there could be no certainty of arriving at a well-marked or general law.

The **Chairman** (Dr. R. Farquharson, M.P.), in putting the proposition of the vote of thanks to the meeting said the paper was a most valuable one. The experiments quoted were made in pre-bacilliary days, but possibly all that would now be claimed for damp soil would be that it was a predisposing cause. He should like to enquire of Dr. Copeman whether any connection existed between cattle tuberculosis and damp meadows, for it was well known that tuberculosis existed more frequently where the cattle were crowded up in byres with a close vitiated atmosphere. Again, it is stated that tuberculosis is more prevalent in the highlands now than ever it was in the days when the people cared nothing for tight houses and artificial methods of ventilation, some of which they knew were horrible. Great credit was due to Dr. Copeman for the paper, and if he could impress on the Local Government Board the necessity of Medical Officers of Health in the various parts of the country conducting a series of experiments on the lines of Buchanan and others a very valuable series of facts might be compiled.

Dr. COPEMAN, in acknowledging the vote of thanks, said there were many points he had purposely avoided, as he was desirous of keeping the paper within decent limits. In his own belief, subsoil-water of itself had very little bearing on disease, but by careful measurements of the rise and fall of this water, together with observations of the varying conditions of soil and air, including the identification of the bacteria present, definite information might in time be obtained. It was important not to overlook the value of Mr. Adams' observations, extending as they did over ten years, and he hoped there would be found in this country other gentlemen sufficiently interested to give their time to the subject. Epidemic diseases were due to the presence in the system of micro-organisms, and the question is, how does the organism gain entrance? He believed it was not infrequently through the medium of drinking-water, or of the subsoil-air drawn or forced into houses. Micro-organisms require for their multiplication a certain amount of heat, moisture, and food; and in the absence of any one of these conditions they tend to remain quiescent, and eventually die. At certain periods temperature sufficiently high would be found in the soil, together with varying quantities of organic matter, and with the rise and fall of the water they would get the necessary amount of moisture for the development of the micro-organism. There were two ways by which the organism might obtain entrance into the system—through drinking-water drawn from wells, or from ground-air rising from the interstices of the earth. He should not like to say that a high level of the subsoil-water was the cause of phthisis, but it was impossible to deny that it might be a predisposing cause. In diarrhœa it was the universal experience that bottle-fed children were the largest sufferers; and naturally so when one considers that the milk on which they are fed is often not only of bad quality, but also is apt to be left standing about for hours in crowded, ill-ventilated, and often filthy houses, where it is exposed to emanations from the soil. It was due rather to these conditions than to the manner of feeding the infant that the percentage of mortality was so large; this being shown by the fact that the use of sterilized milk suffices to cause the disappearance of the disease.

THE ISOLATION OF CASES OF INFECTIOUS DISEASES IN THE METROPOLIS.

By Augustus Charles Scovell, J.P.

Chairman of the Ambulance Committee of the Metropolitan Asylums Board.

Read at a Sessional Meeting, March 11th, 1896.

By the Sanitary Act, passed thirty years ago, power to provide isolation hospitals was given to the Metropolitan Vestries. This enactment, although it has been made use of on special occasions for limited periods (*e.g.*, in 1893 by the Marylebone Vestry for fever patients), must be looked upon as practically a dead letter. The reluctance of Parish Authorities to avail themselves of this power by providing infectious hospitals for their own districts can be easily understood. And we may be thankful that the Act has been generally neglected, and that London is not hampered to-day with the burden of some forty separate hospitals under independent control.

The present organisation had its origin in quite another quarter: its germ is to be found in the Metropolitan Poor Act of 1867.

The workhouses before that time knew of little or no classification of inmates, and each workhouse in addition to the able-bodied, the young, the aged and the infirm, sheltered the imbecile and the idiot, as well as any paupers suffering from fever or small-pox.

In order to clear the London workhouses of the latter classes and to provide for them elsewhere, the London Poor Law Parishes and Unions were constituted one District under managers acting as the Metropolitan Asylums Board.

With its work in relation to the mentally deficient we are not dealing now, but it is well worth observing that for many years after its formation, the Board's functions as regards infectious isolation were restricted to the reception of paupers armed with a formal admission order by a Relieving Officer. Had the term "pauper" been always interpreted by these officials as meaning those only who were paupers at the time of infection, the task of providing for them would have remained unimportant in extent; but it became the custom to grant readily orders of admission to hospital to almost any persons who applied for them. However beneficial it may have been from a sanitary point of view, this practice, which made whole families paupers in order to obtain hospital treatment for one of their members, was open in many respects to grave objections, not the least, perhaps, being the hardship experienced by many ratepaying householders, of small means and unprovided with proper isolation in their homes, who were debarred from the rate-supported hospitals by their honourable dread of pauperism; and at this time it will be remembered that the acceptance of relief even for this purpose meant loss of the political franchise.

In the meantime the attention of the managers had been called to the utter inadequacy of the means taken by the several Boards of Guardians for the conveyance of their sick patients to the infectious hospitals. The mode in which this important duty was frequently discharged by the pauper drivers and nurses to whom as a rule it was confided, induced the managers to obtain powers to establish and maintain a Metropolitan ambulance service.

This central service has long since superseded for infectious disorders the vehicles previously used by the parochial authorities, and there is no doubt that its efficient and humane methods greatly encouraged removals, and had a direct effect in increasing the number of patients admitted to the Board's hospitals. Subsequently, at the earnest request of the managers, the whole question was reconsidered by the Local Government Board, with the result that Parliament in the Act of 1889 removed the pauper restriction and legalised the reception into the Board's hospitals practically of all fever or small-pox patients. From this time, and so long as they had sufficient beds, the Metropolitan Asylums Board removed in their ambulances and received into their hospitals all applicants without distinction of persons or circumstances, a medical certificate of disease being the only credential demanded.

In 1888 a further expansion of the field of isolation work took place, when diphtheria was added to the list of diseases hitherto admitted.

Lastly, the passing of the Notification Act, compulsory as regards London, placed in the hands of the Medical Officers of Health a long desired instrument for dealing with infectious disorders.

The result of the various steps to which I have briefly alluded may be best illustrated by the fact that the rate of admissions to the Managers' Hospitals during some weeks in 1895, rose to 70 per cent. of the cases notified. That the proportion will ever greatly exceed this is, I think, doubtful, in view of the counter attractions, especially for those who can afford to be paying patients, of the London Fever Hospital and the unconquerable objection which some individuals have to parting with their children.

To further illustrate the extent to which the demands for isolation have grown, I may mention that the fever patients removed to hospital by the Board's ambulances during the *two* years 1893–4, numbered 35,455, more than the number (35,123) that were removed during the whole *ten* years 1881–90.

The work of infectious isolation has been for many years divided into the two branches of small-pox and fever, and from the time when the hospital ships were first moored down the Thames at Long Reach, the care of small-pox and fever patients has become more and more dissevered.

Formerly, as many here will remember, the two diseases were treated in adjacent hospitals in London, and it was not till a River Ambulance Service had been organised with all facilities for the conveyance of patients in perfect comfort and safety, that the fact was recognised that nothing was to be gained by detaining the patient in London during the acute stage of his illness and that it was no more injurious to remove him on the first discovery of the nature of his complaint, than later on during his convalescence.

At the present time no small-pox patients are admitted to the Board's London hospitals, which are therefore devoted exclusively to fever and diphtheria.

The only part of the machinery common to the diseases is therefore the Land Ambulance Service, which removes fever patients to the hospitals and small-pox patients to the wharves.

In either case, whether the patient be destined for the wharf or the town hospital, a nurse takes charge of him at his bedside, superintends his safe transport by the ambulance attendants to the vehicle in waiting to receive him, and is responsible for the comfort and warmth of the journey. He lies on an air-tube bed and is supplied with whatever blankets and hot-bottles are requisite. The pace at which an ambulance is allowed to travel is limited, in the patient's interest, to five miles an hour, this however being modified at the nurse's discretion. Every driver is provided with tools to repair any slight breakdown; in case of more serious accident, he telegraphs without delay to his superintendent, who at once dispatches a fresh horse and ambulance to bring on the patient and nurse. As, however, the vehicles are kept in high repair and each is carefully inspected daily by a competent coachsmith, breakdowns are exceedingly rare, and no patient of the two hundred and thirty thousand carried has received the slightest injury while travelling in the Managers' ambulances.

On the arrival at the wharf the patient is submitted to a careful medical examination, which results in some instances in his immediate return home as a case of mistaken diagnosis. In case of doubt, he is detained in one of a group of observation single-bed wards, recently erected with this object at the South Wharf, until all doubt as to the nature of his complaint is dispelled, when he is sent on to the ships or returned home as the case requires.

This sifting process, I need hardly point out, has a twofold advantage; it protects the patient from unnecessary risk of infection by small-pox, and saves the public the cost of his maintenance in hospital.

The River Ambulance Establishment comprises at present three wharves on the Thames, one of which, at Fulham, has up to the present time remained unused. At the South Wharf at Rotherhithe the bulk of the patients are shipped. Here also are the head-quarters of the River Service, the stores, workshops, and superintendent's office, as also the quarters of the nurses and servants employed on board the boats. Off this wharf lie at moorings the steamers not actually running. These boats, four in number, are manned and kept in ordinary repair by men resident in houses, the property of the Managers, closely adjacent to the wharf, and every precaution is taken to prevent the Service becoming a source of infection to the neighbourhood.

Patients are, in times like the present, treated at the Hospital Ships till complete recovery; but should the numbers rise sufficiently to make it expedient, those that are convalescent are taken a journey of about four miles to Gore Farm Hospital, a finely situated range of buildings erected for this purpose and containing about 1,200 beds.

In addition the Managers are about to erect, on an estate of some 300 acres which they have bought near Long Reach, a hospital of 950 beds.

This will make a total of some 2,500 beds available for small-pox, but how far this will suffice for or fall short of the requirements of future epidemic it seems impossible to forecast.

Let us hope that the vigilance and promptitude of the Medical Officers of Health, of which we have had striking examples in recent outbreaks, seconded as I trust they always will be by the best resources of the Metropolitan Ambulance

Service, may check this terrible disease before it can ever again assume epidemic dimensions in London.

I may perhaps be allowed to express an opinion that for the purposes of more thorough protection from small-pox the Metropolitan boundaries should be enlarged, to embrace the West Ham Union, Tottenham, and all other adjacent thickly populated districts. To justify this opinion I may refer to the following facts:—

In the early part of 1894 a serious outbreak of small-pox occurred in West Ham, and as the West Ham Corporation did not possess suitable or sufficient hospital accommodation, and the Managers feared that the disease, if allowed to gain ground, might spread into the Metropolis, they, in the interests of London, agreed to remove by their ambulances and receive into their Hospital at Long Reach any cases arising in the West Ham District. Under this arrangement 156 patients were removed in 1894 and 114 in 1895, or nearly 12 per cent. of the total removals.

I cannot leave this part of the subject without calling earnest attention to the risk of importation and spread of small-pox to which London is constantly exposed by the immigration and the injudicious treatment of the vagrant classes. I trust there will be no unnecessary delay in dealing with this most important question.

To revert to the subject of fever; the position with regard to each description of fever varies considerably.

Scarlet fever, though subject to seasonal ebb and flow, and also to considerable variations in its incidence in one year compared with another, may appear to have a sufficient permanence or fixity of tenure to justify some attempt to gauge its future demands for hospital accommodation, and in this the accumulating statistics of notification ought to prove useful.

Unfortunately the patients for whom Managers have to provide beds are not the average number spread over series of years, but the maximum number, and it is not easy to determine how far we may approach to a maximum provision with reasonable regard to cost.

Looking at the baneful after effects alone of scarlet fever, I am confident that the money laid out in saving children from its infection, and securing the best possible treatment for those so unfortunate as to catch it, is an economical investment.

But I cannot but fear that the erection of hospitals, necessarily costly as infectious hospitals are, sufficient to cope with any possible epidemic, will be found more than the ratepaying public may be prepared to sanction.

The three new hospitals, which are now being or to be erected, together with some additions already in progress at the existing hospitals, and a fourth for convalescents, will go far, it is hoped, to meet all requirements.

But with the growth of population and the increasing preference for hospital treatment, I cannot feel quite confident on this point.

The future of diphtheria requirements is, I think, still obscure. It is true that this disease has gained ground so persistently, as the following table will demonstrate, that its permanency in the Metropolis must be assumed :—

Number of cases of Diphtheria in the Metropolis.

	Year.	Notified.	Deaths.
	1891	5,907	1,329
	1892	7,781	1,856
	1893	13,026	3,196
Including Membranous Croup.	1894	11,188	2,637
	1895	11,223	2,289

Moreover, apart from motives of protection of others, the patient has in many cases an additional incentive to removal in the paramount importance of securing the best possible conditions when an operation seems unavoidable.

The beds at present available for diphtheria are about 570; these probably will be doubled in the next two or three years.

There remain two other diseases to which I must allude.

Typhus happily appears to be a thing of the past in the Metropolis. The cases are exceedingly rare, and are said to be of a modified and not very malignant type.

Enteric fever however continues to claim attention, without very marked variations in numbers. The general hospitals have for some years relieved us of considerable numbers of enteric patients, thus enabling additional wards to be devoted to scarlet fever or diphtheria.

The progress of sanitation in London will, it is hoped, tend to prevent the spread of enteric fever, but it must be borne in mind that many persons undoubtedly contract the disorder out of London from causes beyond the control of Metropolitan authority.

It is, I think, evident that the question of the provision of beds for the infectious sick of London is not yet completely solved, and that those upon whom the duty of supply is cast must face the certainty of being sharply criticised—in slack times for extravagance in building and maintaining partially empty hospitals, and in times of epidemic, for coming to an end of their resources at a time when the needs of the Metropolis are at their sorest.

To the Ambulance Service, however, this consideration does not apply. Its work has hitherto been carried out without failure or even temporary hitch. Experience has shown that even with only three stations the Service has stood the test of many trying emergencies, and the liberality of the Managers and the ready assent of the Local Government Board to the erection and equipment of three more stations will, I trust, place its efficiency beyond a chance of collapse in the future.

The juvenile population of London, viz., those under fifteen years of age, and therefore peculiarly susceptible to scarlet fever and diphtheria, never number less than fourteen hundred thousand. A service, which places at the disposal of any one of these children, with the utmost promptitude, a properly equipped and warmed vehicle and the care of a trained and responsible nurse, performs a work of genuine and substantial beneficence.

But its usefulness must not be measured only by its every day duties towards fever and diphtheria patients. It at the same time stands in full readiness, at the first intimation of danger, to concentrate all its resources on any spot at which the vigilance of the local sanitary officers may detect a threatened outbreak of small-pox.

Speaking as one who has for many years taken a deep interest in sanitary and hygienic progress, I think we must all view with considerable satisfaction the very great developments that have constantly taken place in the valuable and important work of isolation.

Much no doubt remains to be done, but with a continuance of that cordial co-operation which has always existed between the Local and the Central Authorities of London in this department of Public Health, we may safely indulge in a cheerful outlook for the future.

Dr. C. R. **Drysdale** (London) expressed himself as deeply interested in the great London experiment of the Metropolitan Asylums Board in the isolation of infectious diseases. The paper read by Mr. Scovell proved the importance of isolation. Personally he should like to see the notification clauses extended to measles, whooping cough, syphilis, and even to phthisis; by doing which it would be possible to look forward to the time when we could enjoy almost complete immunity from infectious diseases. The real difficulty of coping with them lay in the overcrowding which exists in the poorer parts of London and other large cities, whereby contagion must exist to a large degree. That this is so, is proved by the relative figures of, say, Hampstead and Whitechapel, each district having about 70,000 inhabitants. In the former the birth-rate was 18·8 and the deaths 12; while in Whitechapel the rates were: births 41·0, deaths 24. The comparison of deaths from zymotic diseases in the two districts also showed the difficulty of rapidly increasing numbers in dealing with infection. Whitechapel showed the deaths from measles to be 82, scarlet fever 23, diphtheria 58, consumption 219; whilst Hampstead gave measles 9, scarlet fever 8, diphtheria 14, consumption 45; figures which made him think phthisis is one of the zymotic diseases which should be dealt with. Many districts have 16 per 1000 excess of births over deaths; so that the doing away with the zymotic diseases must lead to a large increase in numbers Eventually we may come down to a birth-rate of 15 and a death-rate of 12: and with this margin for colonising purposes, we should possibly be able to get rid of zymotic diseases.

Mr. Wm. Brown (London) said I do not aspire so high as to take part in this discussion in the sense in which that is generally understood at these meetings, but hearing your very general invitation I have thought I might mention one or two things bearing very intimately on the subject before us. Mr. Scovell very happily put the difficulty to be faced when he said that they had on the one hand to keep up large hospitals, sometimes standing almost empty, and on the other, when times of stress came, these same hospitals were quite inadequate for the cases requiring to be accommodated. That hits the nail on the head. While it defines the difficulty of the problem it also points in the direction of its probable solution. We want something more elastic than a system of isolated buildings. Why not isolate streets? Why not isolate districts? Why not isolate whole towns? These may appear somewhat startling questions to some, but I am in the position of being able to state that what is suggested is not only possible to be done, but that it can be done at a cost that is quite practicable. Take the sewer-gas evil. The Houses of Parliament can be so isolated that no sewer-gas would rise from the sewers in their vicinity. This could be done for a distance of at least 100 yards from their precincts at a cost of £250. Again, it is possible to put the whole of the sewerage of the Fulham and Hammersmith districts, with a population of over 200,000, in a state of absolute immunity from sewer-gas at a probable initial expenditure of £6,000 or £7,000, and an annual expenditure of about £3,000. It is quite unnecessary to point out to this meeting the significance of these facts as regards our special subject, and also as they relate to sanitary economics generally. I may have been overbold in imposing these remarks upon you. I do not forget that when the lions of sanitary science are about, it were prudent, perhaps, that the mice kept quiet in their natural places of safety. I trust, however, you may not refuse to give some consideration to the line suggested by the facts I have mentioned.

Brigade-Surgeon Lieut.-Col. R. PRINGLE, M.D. (Blackheath), felt that although reference was frequently made to the Metropolitan Asylums Board, yet very few people had a thought of the enormous extent of the work embraced in its operations. For instance, take as an example the provision necessary for the isolation and treatment of scarlet fever among the 1,400,000 children under fifteen years of age, all so peculiarly susceptible to this disease; while the fact that nearly a quarter of a million patients had been carried by the ambulances without accidents proved how extensive were the means and how complete the precautions taken to ensure comfort and safety. There was a note of warning, however, in the paper they had just listened to, viz., how long would the ratepayers submit to the cost of providing these hospitals? The best way, he felt, to relieve this pressure and to limit the necessity of building more hospitals for acute cases was to provide Convalescent Hospitals, to which Institutions the recovering cases might be transferred, thus making room for others in the acute hospitals, and giving the convalescent cases a better chance of a rapid and more complete recovery. The Small-pox Hospital was simply a centre of infection, and the aggregation of the disease constituted, in his opinion, a veritable pest house. One hears much about aerial infection. But who can attempt to describe, much less limit, the infection from the small-pox crust powder blowing about in the air around a Small-pox Hospital. A few crusts from a small-pox patient can convey infection from one place to another and inoculate vast numbers. True, this is done by powdering the crust, and applying the moistened powder to an abraided surface. He spoke from experience, for in the Himalayas he had seen whole villages infected in this way by a very few crusts. Small-pox increases by the proximity of susceptible cases far more than is the case with scarlet fever. Hospital accommodation for 2,400 small-pox patients presents a terrible burthen to the already rate-crushed taxpayer; but with the present organised opposition to vaccination, and the utterly unsatisfactory character of the present system of State vaccination, which the latest authority would prop up by Small-pox Hospitals or the unscientific makeshift of re-vaccination, this provision, he was afraid, would have to be greatly increased, for we are absolutely bound hand and foot, and dare not remain unprepared for a small-pox epidemic, which is certain to occur sooner or later, when the fuel for the disease has been collected in sufficient quantity. The protection of four or five million people from infectious disease is a most remarkable work, and its necessity illustrated by the fact that 35,000 patients were removed in two years. The ease with which the gigantic organisation for such a duty can be carried on is well shown in the work of the Metropolitan Asylums Board, where it is divided into small departments, each under the direction of those who have special knowledge and aptitude for the particular work of the department, and in none is this more successfully manifested than in the work of the Ambulance Department under the guidance of the author of the paper under discussion.

Dr. G. **Millson** (Newington) felt that the Ambulance Committee of the Asylums Board was doing very efficient work, and that the Board carried out its important duties, as far as it was able, successfully. Unfortunately, even at the present time, when infectious disease could not be said to be excessively prevalent, it was impossible to find a place for all the cases seeking admission into the hospitals of the Board. In his parish they had a population of 200 to the acre, and should the Board be able always to remove the whole of the cases for which application was made, there would still remain a sufficient number of cases in that overcrowded parish to make the stamping out of infectious disease almost impossible. The cost of each patient was not less than £25. £9,000 was levied yearly upon his parish of 120,000 inhabitants, and he thought it possible that Kensington, with its fewer infectious sick and its higher rateable value, might be paying nearly £40 for each patient. If, however, twice the number of hospitals were built, in his opinion it would be impossible without other measures to effectually stamp out these complaints. Again, what were they going to do with measles? In the recent cases of smallpox in his district all of them had been removed to hospital, and in no single instance had the disease spread. Of enteric fever, as Mr. Scovell had said, we get much from places outside London, yet he (Dr. Millson) thought that the London water was not beyond suspicion in this matter and was accountable for some of the cases. The subject was one of many phases. Even when hospitals were built, and the ratepayer did not mind the expense, there was much to be done. He thought, with an increased notification, some form of local hospital, managed by the Asylums Board, would be found to be a necessity.

Brigade-Surgeon Colonel **Myers** (London) rather hoped some reference would have been made by Mr. Scovell to measles. He believed it would be a most unfortunate thing for the ratepayers if measles were added to the list of isolation disorders, owing to the fact, of which probably many of those present are aware that it was highly infectious some days before the rash appeared, and consequently that isolation hospitals would have little effect in checking its spread whilst entailing an enormous expenditure. Dr. Drysdale, who has just spoken in support of this procedure, wishes also to include phthisis in the group of notifiable diseases. This I am sure would prove a source of *absolute cruelty* to the general public, and except for statistical purposes would lead to no practical good, and I therefore earnestly trust it may never be carried out.

Captain C. W. **Andrew** (London) moved a vote of thanks to Mr. Scovell for the very admirable paper he had read to them, and he trusted they would pass it most cordially, for they had had presented to them an account of the work of the Metropolitan Asylums Board, which deserved the very utmost publicity; for the general public are not aware of the scope of the Ambulance Committee, and the facilities offered them for the removal of cases of infection.

A question was asked as to whether the cost of each patient to the Asylums Board could be given.

The CHAIRMAN (Dr. R. Thorne Thorne), in the course of a few remarks, said that the paper read by Mr. Scovell was a record of the work of the greatest body in the whole world organized for the isolation of the infectious fevers, and hence for the protection of the health of the people. Reference was made in the paper to the "inconquerable aversion which some individuals have to parting with their children," yet when parents came to know how well these hospitals are administered, it is remarkable how easily this "unconquerable aversion" is overcome. With regard to small-pox, it had been stated nothing was to be gained by detaining cases in London; he would go further and say, on the contrary, that such action had led to much harm, the aggregation of small-pox patients near communities being a great mistake. In the period 1871-85, when this aggregation went on in London, the small-pox death-rate ranged from 110 to 2,420 per million; between 1886 and 1891, when small-pox was dealt with out of London, it only once reached six per million, and the mean for the nine years 1886-94 has been 9·3 per million; whereas from 1845 down to 1886, when the London Small-pox hospitals were abandoned, the rate was only once as low as 13, and only in four years did it get below 40. The action taken, which involved the removal of small-pox patients right away from the population and isolating them away down the river, was one of the greatest achievements ever undertaken by the Metropolitan Asylums Board in the interests of public health. It was stated that small-pox was now brought into London from the Provinces; yet there was a time when it nearly always spread from London to the Provinces—it is simply a reversal of order, instead of going as formerly from centre to periphery, the infection now travelled from periphery to centre. The instantaneity of action in the removal of the patients and the excellence of the ambulance work constitute a system of perfection from a sanitary point of view, and provides a condition which, so far as he knew, was enjoyed by no other town in the world. Every case of infectious disease which is thus isolated not only lessens, as alleged, the immediate spread of the disease, but with reference to diseases such as scarlet fever, to which children are specially susceptible, it also enhances the chance of their altogether escaping them; every year of escape decreasing their prospects of ever contracting it at all. Typhus fever had been referred to as gone. Cases are now so rare that the medical profession do not see it, and hence have difficulty in recognising a case of it when it happens to appear. This is a disease which has practically disappeared in the face of improvements in the sanitary circumstances affecting the housing of the people. As to phthisis he felt that they were not yet prepared to add it to the list of notifiable diseases. What could a Sanitary Authority do if cases of phthisis were notified? They could not take action against an individual who, suffering from a chronic ailment, had many years to live, and ought during that period to be allowed to go about and earn a living such as was essential to his well-being, and also to the chances of his recovery. He felt it was rather the duty of the private medical man to tell the sufferer what precautions he ought to take with regard to preventing infection, and that it was not a case for an official of the Sanitary Authority to be calling on the sufferer, and so brand him in the eyes of the public.

Mr. SCOVELL (London) acknowledged the vote of thanks and stated, in reply to a question, that the cost per patient, exclusive of providing the hospital building and equipment, but including the proportion of cost of the staff, had been 25s. per week; a sum which would increase as the number of the staff was being added to, but probably 25s. to 30s. per week would be a good average. The Nursing Staff at present consisted of between 800 and 900; but the avowed policy of the Board was to increase the number owing to the great difficulty of procuring efficient nurses in times of pressure. Skilled nursing was the most essential part of the scheme, and to the nurses detailed to the ambulance duty much of its success was owing, the tact, good temper and methods of dealing with the parents of children being all important. Although the number of objections to the removal of children was diminishing, he felt there would always be a certain number of parents with an aversion to the removal of their children. To deal with these they certainly had certain compulsory powers, yet he felt it would always be best to trust to the growth of popular feeling than to resort to these. Of the cases dealt with at least 85 per cent. are children under fifteen, while almost all can be classed as young persons. Measles, he thought, might be dealt with by the Metropolitan Asylums Board providing accommodation, but only for selected cases of prolonged duration and malignant type from dwellings where proper accommodation could not possibly be provided.

ANNUAL REPORT OF THE COUNCIL,

For the Year 1895.

Read at the Ordinary General Meeting, March 25th, 1896.

INTRODUCTION.

The Council are glad to note that public instruction in Hygiene, the promotion of which is the main object of the Institute, is becoming much more general than heretofore. Each year largely increasing use is made of the facilities afforded by the Institute through its Lectures and Museum for obtaining theoretical and practical knowledge of Hygiene; this subject is more particularly referred to under the headings of "Lectures" and "Parkes Museum," where it may be seen that a very large number of Institutions and Colleges of all grades now include Hygiene in their curriculum.

SESSIONAL MEETINGS.

Sessional Meetings for the discussion of subjects of public interest in connection with Sanitation were held in February, March, April, and December. These meetings afford an opportunity for an interchange of opinions amongst the Members and Associates of the Institute, and the Council will be glad to receive from time to time notice of any subjects which are thought desirable for discussion. During the year the following subjects were brought forward:—

"Dry Methods of Sanitation." G. V. Poore, M.D., F.R.C.P.

"Back-to-Back Houses." James Niven, M.A., M.B., Medical Officer of Health, Manchester, with illustrations of various types of Back-to-Back Houses met with in practice, and the methods adopted for dealing with this class of property, by T. de Courcy Meade, M.INST.C.E., City Surveyor, Manchester.

"Combined Drainage from the point of view of Health Construction, Administration and Law." J. F. J. Sykes, D.SC., M.D., Medical Officer of Health, St. Pancras, and W. Nisbet Blair, ASSOC. M.INST.C.E., Surveyor, St. Pancras.

"The Lessons to be Learned from the Experimental Investigations by the State Board of Health of Massachusetts upon the Purification of Sewage." Sir Douglas Galton, K.C.B., D.C.L., L.L.D., F.R.S.

The papers read during the earlier part of the year, with the discussions upon them, have already appeared in the Journal, Vol. XVI. The paper by Sir Douglas Galton will be published with the proceedings of the other meetings of the Session 1895–6 in Part I. of the Journal for 1896.

The attendances at the meetings varied from 100 to 150.

LECTURES FOR LADIES.

The eighth course of Lectures on subjects connected with Hygiene, especially intended for ladies, was given during Lent by A. T. Schofield, M.D., M.R.C.S. The subjects of the Lectures were Fire, Water, Earth, Air.

Her Royal Highness the Duchess of Albany, Patroness of the Institute, was present at the Lectures.

RECEPTION OF MEMBERS OF THE BRITISH MEDICAL ASSOCIATION.

The Annual Meeting of the British Medical Association was held in London in the Autumn, and the Council arranged to receive at the Museum those members who were interested in Public Health questions.

The following papers were read and discussed during these receptions:

"The Position of Medical Officers of Health in Regard to the Administration and Working of the Infectious Diseases Notification Act." SIR THOMAS CRAWFORD, K.C.B., LL.D., Q.H.S., M.D.

"The Teaching of Hygiene as illustrated by the Parkes Museum." PROF. A. WYNTER BLYTH, BARRISTER-AT-LAW, M.R.C.S., F.I.C., F.C.S.

"The Pollution of Streams." GEORGE REID, M.D., D.P.H.

"The Bacterial Purification of Water." PROF. PERCY FRANKLAND, F.R.S.

These papers have appeared in the Journal, and also an epitome of the papers of Sanitary interest read at the meeting of the Association.

LECTURES AND DEMONSTRATIONS ON SANITARY SCIENCE.

The nineteenth and twentieth courses of Lectures and Demonstrations were held during the year in London. In February and March 125 Students entered their names, and in October and November 130 Students.

Additional Lectures were given on Elementary Physics and Chemistry, and Experimental Classes in the Manipulation of Apparatus were held for an hour preceding these Lectures.

A complete list of the Lectures has been given in Vol. XVI. of the Journal, and several of the lectures have been published.

INSPECTIONS AND DEMONSTRATIONS.

The Council desire to make the course of training given by the Institute as practical as possible, and in addition to the illustration of the Lectures and the Experimental Classes already referred to, arrangements were made for the Students to visit the places mentioned below in order that they might have the opportunity of observing Sanitary principles in actual operation, and noting the difficulties that have to be met in the practical application of Sanitary principles to various trades and processes. The names of the gentlemen who arranged the visits and conducted the Students are also given:—

East London Water Works, Lea Bridge. W. B. BRYAN, M.INST.C.E., Engineer to the Company.

Friern Barnet Sewage Works. E. J. REYNOLDS, ASSOC.M.INST.C.E., Surveyor to the District Council.

Barking Sewage Outfall Works. J. E. WORTH, M.INST.C.E., District Engineer, London County Council.

Southwark and Vauxhall Water Works, Hampton. J. W. RESTLER, M.INST.C.E., Engineer to the Company.

Aylesbury Dairy Co. J. A. HATTERSLEY, Managing Director (2 inspections).

Ealing Sewage and Destructor Works. CHAS. JONES, M.INST.C.E., Engineer and Surveyor to the U. District Council (2 visits).

Beddington Sewage Irrigation Farm, Croydon. THOS. WALKER, M.INST.C.E., Borough Engineer.

Express Dairy Company's Farm, College Farm, Finchley, and Establishment. G. TITUS BARHAM, Managing Director.

East Surrey Water Works, Kenley. Dr. L. W, DARRA MAIR, M.D., M.O.H., Croydon Rural District Council.

Wimbledon Sewage Works and Farm. C. H. COOPER, ASSOC. M.INST.C.E., Engineer and Surveyor to the U. District Council.

Knacker's Yard. HARRISON & BARBER (2 visits).

East London Soap Works. E. COOK & Co.

St. Pancras Disinfecting Station, Family Shelter and Mortuaries. J. F. J. SYKES, D.SC., M.D., M.O.H. (3 visits).

Casual Wards and Disinfecting Station, Chelsea. LOUIS PARKES, M.D., D.P.H.LOND., M.O.H. (2 visits).

St. George's, Hanover Square, Sanitary Works in different stages of progress, Disinfecting Station, Mortuary, &c., Model Dwellings (Gatliff Buildings), and Routine Office Work of a Sanitary Inspector. A. TAYLOR, Chief Sanitary Inspector (4 visits).

London County Council Common Lodging House, Parker Street. FRANK J. RUDDLE (2 inspections).

Richmond Main Sewerage Works. W. FAIRLEY, ASSOC.M. INST.C.E., Engineer.

Disinfecting Apparatus and Model Steam Laundry. W. G. LACY (2 inspections).

During the lectures the Students had the free use of the Library and Museum at all times when they were open, and a special time was set apart each week for the Students to examine the Museum with the assistance of the Curator.

For the convenience of those Students who wished to borrow books for home reading, special arrangements were made for the loan to them, at a small fee, of books from Lewis's Medical and Scientific Library, which contains a large number of recent text books and standard Sanitary works. This arrangement was also available for Members and Associates of the Institute.

PROVINCIAL LECTURES.

Arrangements were made in conjunction with the Technical Education Committee of the Norfolk County Council and the Norwich Corporation, for a Course of Lectures to Sanitary Officers at Norwich. A list of the lectures appeared in the Journal.

The Council desire to record their sincere thanks to the Lecturers, both in London and Norwich, for the great benefits they have conferred upon the Students, and for the assistance they have given to the diffusion of Sanitary knowledge, by the preparation and delivery of these Lectures, and also to those who have taken much trouble to make the various visits instructive to the Students.

The pioneer work in teaching Sanitary Officers commenced by the Institute ten years ago is now, the Council are glad to see, being followed by many other Associations and County Councils, who are adopting step by step the principles and methods laid down by the Institute.

As an instance of the wide and beneficial influence of the teaching work of the Institute, it is interesting to note that in The Indian Manual of Hygiene, edited by Surg.-Capt. Grant, Prof. of Hygiene at Madras Medical College, and published under the authority of the Indian Government, the course of Instruction given by the Institute is quoted in detail as a typical one in laying down the principles on which Sanitary Officers should be trained; and application has been received from Hong Kong for information to assist them in starting a similar course of training.

EXAMINATIONS.

IN PRACTICAL SANITARY SCIENCE.

Early in the year it was pointed out to the Council that there are many persons who have no intention of becoming Sanitary Officers who desire to obtain a Certificate from the Sanitary Institute indicating their knowledge of Sanitary Science, and the Council therefore thought it desirable to arrange a syllabus which, although not including many technical subjects that an Inspector is required to know, goes beyond the scope of the Inspectors' Examination as far as relates to Practical Sanitation. The Examination is arranged so as to be suitable for Foremen of Works, Builders and those engaged in allied Trades, Managers of Property, Teachers and Lecturers, and others requiring a thorough knowledge of Practical Sanitary Science.

Two Examinations were held: one in May and one in December.

FOR SANITARY INSPECTORS.

Examinations were held at the following places:—

London (2 Examinations).
Bristol.
Newcastle-upon-Tyne.
Southampton.
Leicester.
Huddersfield.
Norwich.
Cambridge.
Manchester.

At these Examinations 495 Candidates presented themselves, and 303 were certified competent, as regards their Sanitary knowledge, to discharge the duties of an Inspector of Nuisances under the Public Health Act, 1875, or of a Sanitary Inspector under the Public Health (London) Act.

The Examinations were established in 1877, and the following figures show the total number of Examinations held, and the number of candidates :—

	Examinations.	Candidates Entered.	Candidates Certificated.
For Local Surveyors	35	291	142
Practical Sanitary Science ..	2	40	19
Sanitary Inspectors	77	3307	1938
	114	3638	2099

Certificates of Competency are now required for all newly appointed Inspectors in London, and are also specified in the advertisements of 139 Provincial Authorities. In some districts the Inspectors already in office are encouraged to go up for Examination, by the Local Authorities paying the Examination fees or by being given an increase of salary on obtaining a Certificate, and in some cases half the fees.

There is now before the Local Government Board a scheme for the formation of a Sanitary Inspectors' Examination Board, composed of representatives from various Societies. The Sanitary Institute have been invited by The Local Government Board to join in the scheme, but in its present form the Council consider that it would be detrimental to the public interests, and also to the interests of the 1,938 candidates who have passed the Examination of the Institute. The Council have therefore suggested that, if any alteration of the present system is necessary, the scheme should be modified so as to meet these objections.

The Council very much regret that Mr. G. J. Symons, F.R.S., who has for the past sixteen years laboured so earnestly in the development and organization of the Examinations of the Institute, has resigned the office of Registrar, and they feel that the thanks of the Institute are due to Mr. Symons for the signal service he has rendered in its work.

Sir Wm. Guyer Hunter, K.C.M.G., has kindly consented to accept the office.

SANITARY LEGISLATION.

The Parliamentary Committee of the Institute had before them and reported to the Council upon the following Bills introduced during the year. The action taken by the Council and the fate of the Bill is noted in each case :—

Architects' Registration Bill. Brought in by Mr. Atherley Jones, Mr. Coddington, Mr. Walton, and Mr. Ernest Spencer.

A Bill to provide for the registration of Architects, and thus enable persons who require professional aid in architecture to distinguish a qualified from an unqualified practitioner.

The Council petitioned against this Bill as the objects proposed appeared to be already attained by the Royal Institute of British Architects and allied Societies.

The Bill was eventually dropped.

Sanitary Registration Bill. Brought in by the Marquis of Ailesbury.

This Bill, which, with slight modifications, had been before Parliament for several years, was again brought forward.

The Council petitioned against the Bill, as a new authority to regulate sanitary matters would be created which would inevitably clash with already constituted Local Authorities; compulsory legislation was therein proposed, under which every dwelling house, school, college, hospital, asylum, workhouse, factory, workshop, hotel and lodging-house, would have to be inspected by special instead of public Authorities. The Bill was not reached before the close of the session.

Plumbers' Registration Bill. Brought in by Mr. Knowles, Sir Algernon Borthwick, Earl Compton, Mr. Dixon, Dr. Farquharson, Dr. Bowen Rowlands, and Mr. Sexton.

This Bill, which was first introduced in 1872, was again brought forward. The Council petitioned against the Bill, which was not reached before the close of the session.

Rivers Pollution Prevention Bill. Brought in by Sir Francis Powell, Mr. Henry Hobhouse, Sir John Dorington, Mr. Kenrick, Sir John Barran, Sir Henry Howarth, and Dr. Farquharson.

A Bill to make more effectual provision for prevention of the pollution of Rivers and Streams.

The Council petitioned in favour of this Bill, but suggested that the clause relating to solid matter in suspension should be so amended as to include this as a pollution. The Bill was not reached before the close of the session.

Factories and Workshops Bill. Brought in by Mr. Secretary Asquith, Mr. George Russell, and Mr. Sydney Buxton.

A Bill to amend and extend the Law relating to Factories and Workshops.

The Council wrote to the Home Secretary approving of the general scope of the Bill, but stating that they considered that Clause 6, relating to the making of wearing apparel in any part of a building in which any inmate is suffering from infectious disease, was too sweeping as drafted, as it would stop the employment of persons living in large Artizans' Dwellings, even when the rooms they occupy were remote from persons suffering from infectious diseases. They suggested the addition of a few words to the effect, "unless the patient is isolated to the satisfaction of the Medical Officer of Health."

Before the Bill was passed this clause was amended, and its operation limited to a dwelling-house or building connected therewith, and the Bill received Royal assent.

Public Health Amendment Bill. Brought in by Sir Albert Rollit and Sir Thomas Roe.

A Bill to amend the Public Health Acts with respect to the definition of Drains and Sewers.

This Bill was eventually withdrawn.

Cremation Bill. Brought in by Sir Thomas Roe, Sir H. Seymour King, and Mr. Charles Wilson.

A Bill to empower Burial Boards and Local Authorities to provide for Cremation.

The Council considered this Bill and decided to Petition in its favour, and to suggest its extension to Burial Boards and Local Authorities who may not have provided their district with a Cemetery, but owing to the dissolution of Parliament the Bill was not reached, and the Petition was not presented.

Public Health Bill. Brought in by Lord Stanley, Sir William Houldsworth, and Mr. Seton Kerr.

A Bill to confer additional powers upon County Councils for securing uniformity in the administration of the Public Health Acts within their districts.

This Bill being of an administrative rather than of a Sanitary character no action was taken by the Council with reference to it, and the Bill was eventually withdrawn.

In connection with Sanitary legislation several important cases were decided in the Courts under the various Acts dealing with Public Health. Some of these cases which were of special interest were noted in the Journal.

PARKES MUSEUM.

There has been an increase in the attendance, and it is estimated that 25,000 persons visited the Museum during the past year.

A marked increase has occurred in the Student Class of visitors. The fuller appreciation of the usefulness of the Museum by Institutions which include Hygiene in their teaching has been noticeable for some years, and from the following statement it will be seen that during the past year this fuller appreciation has been indicated in the most striking manner.

	Institutions.	Classes.	Students.
1892	13	68	854
1893	21	87	1043
1894	28	48	865
1895	50	93	1695

The list of Institutions represented which follows, includes several Board Schools, but the pupils from these were for the most part attending science classes at those schools, or were connected with organisations of the teachers.

LIST OF INSTITUTIONS.

Aldersgate Street Y.M.C.A.
Bedford College.
Birkbeck Institute.
Borough Polytechnic.
Brighton Training College.
Capland Road Board School.
Central Nursing Institute.
Charing Cross Hospital.
Charterhouse School.
City of London College.
Clarendon Square Science School.
Clyde Street Pupil Teachers' School.
Croydon Polytechnic.
Croydon Y.M.C.A.
Eastbourne Technical Institute.
Exeter Hall Science Branch.
Finsbury Pupil Teachers' School.
Glengall Road Board School.
Gloucester Road Board School.
Highbury Institute.
Jews' Free School.

King's College.
London Hospital.
Maria Grey Training College.
Marylebone Higher Grade School.
Metropolitan Nursing Association.
Montem Street Board School.
National Health Society.
National School of Cookery.
North-East London Institute.
Notting Hill Gate Institute.
People's Palace, Mile End.
Physical Training College.
Polytechnic, Regent Street.
Post Graduate Course.
Shoreditch Polytechnic.
St. Andrew's Science School.
St. George's Hospital.
St. Thomas's Hospital.
Surrey County Council (Plumbers' Class).
Tottenham Technical Institute.
Tunbridge Wells Institute.
University College, London.
Wandsworth Rd. Science School.
Westbourne Park Institute.
West Kensington Science School.
Westminster Technical Institute.
Whiteland's College, Chelsea.
Wood's Road Science Classes.
Woolwich Polytechnic.

Several new exhibits have been added, including a number of appliances premiated at the Exhibition of the Institute held at Liverpool.

Three new models have been fitted up, namely, one to demonstrate the amount of water absorbed by bricks resting on wet soil, a section (full size) of the Grand Junction Company's Filter Bed, and an elaborate model presented by Mr. J. Wallace Peggs, to demonstrate the underground movement of water in relation to a surface well in pervious strata. A complete List of the Exhibits presented is given each quarter in the Journal.

A new feature was introduced early in the year which promises to become very popular amongst the Members for Teaching and Lecturing purposes, viz., a Lantern Slide Collection, containing upwards of 300 Slides, illustrating Bacteriology, Physiology, Physics, Meteorology, Building Construction, Water Supply, Drainage, House Sanitation, Ventilation, Foods, &c. These are now available on hire at a nominal charge, and have already been used at Lectures in Liverpool, the Isle of Wight, Wales, and many London Institutions. A List of these Slides may be obtained from the Curator.

LIBRARY.

During the year there have been 560 readers. 362 volumes and pamphlets have been presented to the Library. Lists of these were published in Vol. XVI. of the Journal.

The Library contains, besides recent Text Books and Works on Hygiene and Sanitation, Extensive Sets of Parliamentary and other Official Reports, and Transactions of other Societies. The Council are always glad to receive recently published books on subjects relating to Hygiene, and these are reviewed or noticed from time to time in the Journal. They are also glad to receive old Official Reports, as they are frequently found useful in completing sets.

Catalogue of the Books and Pamphlets contained in the Library, which number about 7,000, is now in hand, and nearing completion.

SANITARY PUBLICATIONS.

Considerable additions have been made to Sanitary literature during the year, and the quarterly lists of books presented to the Library, which are published in the Journal, show that new books have appeared in nearly all branches of Hygiene and Sanitary Science. The number of new text books and manuals indicate partly a desire for information up to date in this rapidly-growing science, and partly, also, an attempt to meet the wants of students who are taking up the subject for different purposes.

The reviews and notes on books which are published in the Journal deal with the volumes of general interest, and it is not necessary to refer further to them here.

JOURNAL.

The quarterly publication of the Transactions, which was commenced in 1894, has proved very satisfactory. Among the papers published the Council have included some of the Lectures given to Sanitary Officers, which will no doubt be found useful to Students and others. They have also inserted short notes on the books presented to the Library, and on papers of Sanitary interest contained in the Transactions of other Societies.

FINANCE.

Owing to the rapid growth of the Institute and the further accommodation and facilities given to the Students, which have necessitated an augmentation of the Staff and a largely increased annual charge for the premises, the expenditure for the past three years has exceeded the income, and the best means of providing for this deficiency has been the subject of careful investigation by the Council.

A comparison of the Annual Statements of Accounts since 1892, shows that the income is steadily overtaking the expenditure, notwithstanding the enlargement of the premises, and if the accounts for the year 1896 show a proportionate increase, the expenditure should be fully met.

The Council would point out that the Parkes Museum involves a large anuual outlay which absorbs the balance in other branches of the work, but as has already been shown in the report, the Museum is most valuable and largely used as an educational centre, and the Council do not think that it would be desirable to curtail its usefulness, nor to give up other public educational work that the Institute has undertaken.

They have, however, by the co-operation of the Examiners and Lecturers, and others who are aiding in the work of the Institute, been enabled to effect a considerable reduction of expenditure, and they have also adopted measures with the object of increasing the income. The matter still occupies the serious consideration of the Council: they find it necessary to propose that a portion of the investments should be realised in order to meet certain items of expenditure, which should be charged to capital, and have been passed as such in the accounts, although no funds have been realised to meet them.

EPITOME OF THE WORK OF THE INSTITUTE, 1895.

LONDON LECTURES AND EXAMINATIONS.

		Total Attendance.
4	Sessional Meetings for discussion of Sanitary subjects ..	488
4	Lectures to Ladies on Domestic Hygiene	235
12	Demonstrations in Physics and Chemistry	133
4	Receptions during Meeting of B.M.A.	223
48	Lectures to Sanitary Officers	4959
29	Practical Demonstrations for Sanitary Officers	1044
2	Examinations in Practical Sanitary Science	40
2	Examinations for Sanitary Inspectors	289
99	Classes brought to Museum	1695
	Other persons visiting Museum	17,267

PROVINCIAL LECTURES AND EXAMINATIONS.

12	Lectures to Sanitary Officers	420
8	Examinations Sanitary Inspectors	206

EPITOME OF REGISTERS OF MEMBERS AND ASSOCIATES.

The comparison of the roll of the Institute with the preceding year shows a considerable increase in the number of Members and Associates.

	Hon. Fellows.	Fellows.	Members.	Associates.	Total.
Dec. 31st, 1894	25	152	547	798	1522
Dec. 31st, 1895	28	151	573	913	1665

OBITUARY.

It is with much regret that the Council have to report the death of Sir THOMAS CRAWFORD, K.C.B., M.D., Q.H.S., LL.D., and THOMAS TWINING, *Vice-Presidents.* Prof. LOUIS PASTEUR, *Honorary Fellow.* JOHN SYER BRISTOWE, M.D., F.R.S., CHARLES HENRY PARKES, and ERNEST TURNER, F.R.I.B.A., *Fellows.* THOMAS W. KYLE, M.D., T. PAGLIARDINI, and J. B. MITCHELL WITHERS, F.R.I.B.A., *Members.* J. BAXTER, S. M. BURROUGHS, G. R. COBHAM, Rev. C. G. K. GILLESPIE, M. OUTRAM, G. STEERS, H. J. TRIGG, and THEODORE VEST, *Associates.*

A. WYNTER BLYTH,
Chairman of Council.

E. WHITE WALLIS,
Secretary.

STATEMENT of INCOME and EXPENDITURE

Dr.

Expenditure.	£	s.	d.	£	s.	d.
To Rent, Rates, Taxes, and Insurance	441	17	1			
,, Salaries and Wages	1,139	15	6			
,, Coals, Lighting, and Care of Offices......	133	9	11			
,, Repairs and Alterations (Museum)	18	4	0			
,, Maintenance of Museum.....................	51	2	4			
,, Library, Binding, &c.	14	6	7			
,, Postage and Carriage	137	1	2			
,, Printing and Stationery	135	6	6			
,, Incidental Expenses............................	66	10	8			
,, Law Charges	35	16	0			
,, Office Furniture	1	6	0			
,, Depreciation of Leaseholds..................	75	0	0			
				2,249	15	9
To Journal and Publications, Cost of Printing, &c., less Sales and Advertisements	316	1	10			
,, Sessional Meetings	23	13	0			
,, Lectures, Sanitary Officers	356	13	11			
,, ,, Domestic Hygiene	34	16	8			
,, Examinations....................................	901	10	7			
,, Congress and Exhibition......................	21	8	4			
,, Illustrated List of Premiated Exhibits...	1	4	6			
,, British Medical Association Meeting ...	14	3	0			
				1,669	11	10
				£3,919	7	7

	£	s.	d.	£	s.	d.
To Expenditure on New Premises and Extension of Museum........................	76	15	8			
,, Depreciation of old stock of Transactions	388	6	6			
				465	2	2
,, Balance for the year 1895 brought down				320	7	1
,, Balance to be carried forward				8,975	7	5
				£9,760	16	8

Examined with the Books and Accounts and found correct,

Alfred Lass, Wood & Co., Chartered Accountants, } *Auditors.*
Magnus Ohren, Assoc.M.Inst.C.E.,

March 3rd, 1896.

for the Year ended 31st December, 1895.

Cr.

Income.	£	s.	d.	£	s.	d.
By Annual Subscriptions	1,107	6	6			
„ Entrance Fees	46	4	0			
„ Fellowship Fees	21	0	0			
„ Donations	48	16	0			
„ Interest on Investments	209	7	11			
				1,432	14	5
„ Lectures, Sanitary Officers	400	6	7			
„ „ Domestic Hygiene	16	3	11			
„ Examinations	1,744	8	2			
„ Publications—Farr's and Simon's—Profit on Sales	5	7	5			
				2,166	6	1
				3,599	0	6
„ Balance, excess of Expenditure over Income for the year 1895, carried down				320	7	1
				£3,919	7	7

	£	s.	d.
By Balance brought forward from last account (1894)	9,260	16	8
„ Estimated Increase in Value of Museum and Library by gifts during the past five years	500	0	0
	£9,760	16	8

GENERAL BALANCE SHEET,

Liabilities.	£	s.	d.
To Fees and Subscriptions paid in advance for 1896...	91	7	0
„ Life Composition Fund	252	0	0
„ Library Catalogue Account..................................	116	19	3
„ Sundry Creditors	414	11	7
„ Temporary Loan from Bankers............................	400	0	0
	1,274	17	10
„ Balance of Assets over Liabilities........................	8,975	7	5
	£10,250	5	3

Examined with the Books and Accounts and found correct,

Alfred Lass, Wood & Co., Chartered Accountants, } *Auditors.*
Magnus Ohren, Assoc.M.Inst.C.E.,

March 3rd, 1896.

31st DECEMBER, 1895.

Assets.	£	s.	d.
By Leases of Premises, Library and Contents of Museum, Furniture, and Publications	1,938	13	6
„ Subscriptions in Arrear and Sundry Debtors	182	5	9
„ Cash in hand	102	8	6
„ Investment (£8,248 11s. 1d. Consolidated Stock) valued at cost	8,026	17	6
	£10,250	5	3

REVIEWS OF BOOKS.

HYGIENE.*

The favourable reception awarded to the first edition of this book has necessitated the issue of a second within a year. The book is an excellent one in every way and is worthy of the high reputation of its authors. Within a small compass there has been collected all the most important facts and principles concerned in the science of Hygiene, and yet the material is presented in a thoroughly readable and agreeable form. The information contained is invariably authentic and up-to-date, and students may rely upon the accuracy and correctness with which the work has been compiled. The last chapter contains a summary of the existing sanitary law of the country, and will be found very helpful by those who have to acquire an acquaintance with this subject. The subject is one difficult to deal with in the few pages of a chapter, but every one who examines the amount of detail here contained will acknowledge that the authors have extracted the gist of the enactments, by-laws and regulations for the benefit of their readers. It is quite evident that it will not be long before a third edition of this excellent manual will be required.

L. C. P.

DOMESTIC ECONOMY.†

This Reader for Standards VI. and VII., seems a useful and instructive contribution to the needs of the Board School children of the day.

Enough has already been done in giving instruction beyond children's comprehension, which not having assimilated they can only in due time forget; and it would be well now to give children an ideal of what their homes should be in the housing, clothing, and feeding of its inmates; and while the standard would probably be above the reach of many of the poorest, yet the teaching would have an elevating effect upon all, and would suggest and lead to improvement where the perfection was beyond attainment. More domestic teaching and inspiration of the young of to-day will possibly be found to be the solution of the great social problem of the housing and tending of the poor of the next generation.

The little manual follows the rational line by bringing before the children's minds the homely occupations of life in a pleasant bright manner. The book is printed in good style and the illustrations are effective.

In the chapter on Warming the House, however, it seemed hardly worth while to call attention to closed stoves, as they are acknowledged by all sanitarians to be one of the least healthy modes of warming, and in the chapter on everyday ills, it would have been well for the writer to have confined herself to teaching only preventive measures and nursing, the use of curative medicine such as aconite and corrosive sublimate should hardly be taught to young girls in such an irresponsible manner as by a school reader.

I. W.

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* Hygiene, by Prof. J. Lane Notter, M.A., M.D., and Surg.-Major R. H. Firth, F.R.C.S. 8vo., 426 pp. Longmans, Green & Co. Price 3s. 6d.

† 200 pp., Crown 8vo. Longmans, Green & Co. Price 1s. 9d.

NOTES ON BOOKS AND PAPERS IN TRANSACTIONS.

"An Essay on Malaria and its Consequences." By ROBERT LINDSAY, A.M., M.B., F.R.C.S.E. 116 pp., 8vo. *H. K. Lewis. London*, 1895. *Price 4/-.*

The Author here deals with the cause and treatment of Malarial Disease based on personal experience while serving with the Army.

"Army Medical Department Report for the year 1894." Vol. XXXVI. 391 pp., 8vo. *Eyre & Spottiswoode. London*, 1896. *Price 1/10.*

The greater portion of this report is taken up with Reports on the Health of Troops at home and abroad.

Included is a report by Prof. J. Lane Notter, M.A., M.D., reviewing the progress of Hygiene during 1895 and referring to legislation and literature for the year; under "Special Points of Hygiene" to the following: Diphtheria, Vitality and Detection of Pathogenic Bacteria in Water, Enteric Fever, and the Disposal of Excreta, Filtration of Potable Water, Disinfectants, &c.

From the Report we learn that the subject selected for the next "Parkes Memorial Prize" is "The Etiology, Prevalence and Prevention of Diphtheria." The Prize consists of Seventy-five Guineas in money and a Bronze Medal. The competition is open to Medical Officers of the Army, Navy, and Indian Services, of Executive Rank and on full pay, with the exception of Assistant Professors of the Army Medical School during term of office.

"A Sanitary Survey of Glamorganshire." By WILLIAM WILLIAMS, M.A., M.D., D.P.H.(Oxon.), County Medical Officer. 118 pp., 8vo. *Daniel Owen & Co. Cardiff*, 1895.

This is practically Dr. Williams' thesis presented for the M.D. degree at Oxford. It is claimed to be the first systematic sanitary survey of its kind ever made of any County in England and Wales.

Part I. is devoted to the physical features of the country; Part II. to its health, history and vital statistics; and Part III. to the sanitary condition of the various districts.

"History of the Cholera Controversy, with directions for the treatment of the disease." By Sir GEORGE JOHNSON, M.D., F.R.C.P., F.R.S. 78 pp., 8vo. *J. & A. Churchill. London*, 1896. *Price 3/-.*

A history of the pathology and treatment of Cholera during more than forty years, and essentially a record of the author's personal experience in the treatment of the disease.

"Sewerage and Sewage Disposal." By Prof. HENRY ROBINSON, M.Inst.C.E. 192 pp., 8vo. *E. & F. N. Spon. London*, 1896. *Price 12/6.*

In the course of his professional practice, the author, having had occasion to investigate the information available to Engineers through the researches of Chemists and Biologists, in relation to Water Supply, Sewerage and Sewage Disposal, has here made a summary of the most important data, dealing at the same time with the allied subjects of Water Pollution and Filtration, and Sewage Purification.

The chief conditions to be complied with in the Drainage of Houses and the Sewering of Towns and the calculation of the Flow in Sewers are also summarised.

The book contains a number of tables, formulæ, and statistics, relating to sewerage and sewage disposal.

"The Law Relating to Building, with Precedents of Building Leases and Contracts and other forms connected with Building and the Statute Law relating to Building, with Notes of Cases under the various Sections." By His Honour Judge EBDEN, assisted by HENRY JOHNSTON, Barrister-at-Law. Third Edition. 690 pp., 8vo. *Knight & Co. London*, 1895. *Price 18/-.*

This work claims to be both practical and complete on the extensive subjects of which it treats.

Besides the subjects named in the title, information is given relating to Cesspools, Water Closets, Sewers, Drains, Nuisances, and other matters of Sanitary Interest, and there is a comprehensive Index occupying 67 pages.

"Weather and Disease: a Curve history of their variations in recent years." By ALEX. B. MACDOWALL, M.A., F.R.Met.Soc. 83 pp., 8vo. *The Graphotone Co., London*, 1895.

The author, believing that the question of the influence of the weather on health is a subject which is greatly in need of elucidation, has written this little work with the object of giving an idea of the way in which certain elements of our weather, and the mortality from some well-known diseases, have varied in recent years. The method adopted is by means of graphic curves on charts, divided into squares, which the author avers makes the whole thing clear at once, and is to be preferred to dealing with columns of figures.

There are in all 36 charts and 36 pages of explanatory matter. Twenty of the charts deal with the "Weather"—Rainfall, Winters, Frosts, Summers, Sunspots, Thunderstorms, Seasons, London Fogs, &c.; and sixteen with "Disease"—Measles, Diphtheria, Scarlet Fever, Small-pox, Whooping Cough, Respiratory Diseases, &c.

THE PURIFICATION OF SEWAGE BY BACTERIAL OXIDATION IN ARTIFICIALLY AERATED FILTERS.

By George E. Waring, Junr., M.Inst.C.E.
(Fellow.)

The agents which effect the disintegration of dead organic tissues have but recently been identified. It was long thought that the destruction was accomplished by the direct chemical action of the oxygen of the air, but it is now known that minute living organisms (bacteria) are the means of combining organic wastes with oxygen and reducing them to the condition of plant food.

These bacteria are universally present. In many minds they are associated only with disease, but the proportion of germs which are inimical to man is infinitely small; the great majority of them are not only harmless but beneficent, in fact, they are absolutely indispensable, for without them plant food would be quickly exhausted, and animal life would be buried in its own filth.

The processes of disintegration may be broadly divided into two classes—decomposition and putrefaction (with many intermediate forms of change). Both accomplish the same ultimate effect—the reduction of complex organic structures into their original elements. This result is reached by a succession of changes. In decomposition these changes are inoffensive, and not injurious to health; in putrefaction the intermediate products are disgusting and dangerous. The essential difference between decomposition and putrefaction is, that in the former the oxidizing bacteria can work effectively only in the presence of abundant air, while the agents of putrefaction require little or no air for their operations. As organic structure gives way under decomposition, its constituents combine with atmospheric oxygen to form carbonic acid, water and mineral salts. As similar matter is disintegrated by putrefaction, the changing elements, in the absence of air, recombine and form offensive compounds, some of which are poisonous. It is the latter process which produces the disgusting changes and probably dangerous conditions in sewage which has been stored in mass, as in a cesspool.

If the same sewage be spread in thin sheets over the surface of the soil, so as to be freely exposed to the atmosphere, its impurities will be attacked by the bacteria of decomposition, the elements set free will be oxidized and inoffensively reduced to mineral form, and the purified water will sink into the ground, to reappear later in springs or wells. As the water subsides, the air will follow it into the pores of the surface soil, so that any decomposable matter lodged in them will be attacked and completely destroyed. After a short period of rest, another application of sewage may be made, and this will be disposed of in the same way. If sufficient intervals be allowed between the applications, the tract will continue to receive and purify sewage indefinitely; indeed, as the bacteria in the soil multiply under the regular feeding, its capacity will increase rather than diminish. This is the substance of the method of disposal known as Broad Irrigation. The purification is accomplished by a purely natural process. All that we need to do is to bring the sewage, at regular intervals, into contact with a suitable area of soil.

The practice of Intermittent Downward Filtration is identical in theory with that of Broad Irrigation, and the *efficiency* of the two processes is practically equal. There is, however, a difference in *capacity* in favour of filtration, due to a more careful provision and maintenance of conditions which promote activity of the purifying organisms. The filter-beds are composed of natural soil, carefully selected for its porosity and under-drained, or are artificially constructed of suitable material. In this process the purification is accomplished, not only *on* the surface of the soil, but *under* the surface; for, in a properly constructed filter-bed, the material is so porous that, as the applied sewage sinks away, the air which follows it can penetrate the mass and make bacterial oxidation possible at a considerable depth. By thus extending the zone of bacterial activity downward, the capacity of a given area is much enlarged; for the purification depends upon the exposure of the sewage *for a certain length of time* to the action of the oxidizing organisms, and it is obvious that, without reducing this period of exposure, sewage can be passed more rapidly through a deep layer of purifying material than through the shallow layer upon which the process of irrigation depends.

In both irrigation and filtration, purification is secured, not by the mechanical straining which the sewage receives in its passage through the soil, but by the exposure of the liquid to bacterial action, in thin films, upon the surfaces of the particles of filtering material which are in contact with the air. Wherever air can penetrate the bacteria can live and act.

The thorough aeration of the soil, which, in both irrigation and filtration, depends upon gradual absorption from the atmosphere as the water of saturation sinks away, is, necessarily, a slow process. The amount of oxygen available for nitrification is, moreover, limited; for, when once the pores of the soil have filled with air, the underground atmospheric circulation is so slight that fresh oxygen is not supplied to take the place of that which has been used up, and the gaseous products of decomposition are not carried away, but remain to hinder, to constantly increasing degree, the purification which is taking place.

In 1891 it occurred to the writer that the capacity of a filter-bed might be increased by artificially supplying the air needed for the stimulation and sustenance of bacterial action. It seemed probable that the use of air under pressure would not only ensure the introduction of oxygen to every part of the filter but would make it possible to change its gaseous contents as often as might be found desirable. To determine the value of this theory, an experimental plant, on a practical working scale, was erected and put in operation at Newport, R.I., in 1894. In outline, the process consisted of the mechanical deposition in filter beds of all solid matters carried in suspension in sewage, and their subsequent destruction by forced aeration, and the purification of the clarified sewage by bacterial oxidation of its dissolved impurities in an artificially aerated filter.

The details of the construction and operation of this plant have already been published.* It is sufficient for the purpose of this paper to say that the results accomplished exceeded the most sanguine expectations. The sewage used (pumped from the main outfall sewer of the city) contained not only the fresh wastes normally present but the putrid overflow of many old cesspools, yet the liquid leaving the tanks was clear, white, odorless and tasteless. It was collected in a large tank, where discoloration would have been at once apparent, and in this tank fish lived and thrived. Engineers and committee-men drank of it freely and pronounced it good, and frequent chemical analyses proved it acually clean—a good drinking water. An average of the figures representing the purification accomplished showed that 92·5 per cent. of the organic matter was removed. At one time a removal of 99·08 per cent. was effected.

This complete regeneration continued through five months until the experiment was concluded. The filtering material was never renewed, yet when the tanks were taken apart it wás found to be as clean and sweet as beach-washed gravel. There was absolutely no suggestion of the hundreds of thousands of gallons of sewage which had passed through it. The filth had completely disappeared. The complex organic matters had been broken up into harmless mineral elements, some of which had escaped into the air, while the rest passed out with the effluent water.

Plans have recently been prepared for a sewage disposal plant, capable of purifying 1,000,000 gallons of sewage per day to a drinking water standard by filtration with forced aeration. The illustrations facing page 80 represent a half plan of the filters with their distributing and collecting channels, and vertical sections showing the construction of the filters, means provided for drainage and aeration, &c.

In order that the essential features of the plant might be shown in the simplest and clearest form, free from complications incident to the overcoming of unfavorable natural conditions, it has been assumed that sewage can be delivered to the works by gravity, and that there is sufficient natural slope to admit of gravity removal of the effluent leaving the filters. The pumping of sewage or effluent is obviously a matter of secondary importance, easily arranged by any competent engineer when once the theory of the process by which purification is accomplished is understood.

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* "The Purification of Sewage by forced Aeration," which can be obtained, in pamphlet form, on application to the writer at Newport, R.I., U.S.A.

The following is a description of the plant:—

SCREENS.

Before entering the filter-beds, the sewage passes through a screening chamber, which consists of two channels, side by side, with suitable gates for turning the flow into one or the other at will. Each of these channels is furnished with two removable vertical galvanized screens, the upper one of rods, say 1¼ inches apart (centre to centre), and the lower one of ½ inch square mesh netting. These screens withhold the larger floating substances which are not capable of rapid disintegration. The objects retained by the upper and coarser one will be chiefly orange and lemon rinds, brushes, towels, rags and similar articles of an inoffensive nature, which can be dried and burned. The accumulations of the lower and finer screen will probably contain more putrescible matter. Much that is detained as the sewage flows through will gradually be broken up and will pass on to the filters. The remainder, if found objectionable, may be burned.

APRONS.

From this chamber the sewage passes to the distributing channel which lies between the shallow beds or "aprons" of broken stone, to which it escapes through openings which can be closed at will by sliding gates. The aprons are paved with brick set in cement mortar, and are divided by low brick walls. They are covered with coarse broken stone, 8 inches deep, save for a space 3 feet wide at the foot of each bed, which is left bare to facilitate the occasional forking over of the stone. When this is to be done, a strip of stone 3 feet wide, next to the foot of the bed, can be turned over on to the empty paved space. Another strip can then be forked on to the strip originally occupied by the stone just moved, and the operation can be repeated until the entire bed has been turned over and the space at the upper end, next to the inlets, is laid bare. When it is found desirable to fork over the stone again, the procedure is reversed and the bed is restored to its original position. This operation is only necessary at considerable intervals, but it is very useful in that it breaks up and tears apart the fibrous matters which it is the duty of the apron to remove, and which are often slow to decay. At other times, the aprons are cleansed merely by drainage and exposure to the air. It is, of course, important that the sewage be free from silt, for if this gets into the system in considerable quantity, it must be removed mechanically.

The aprons are to be used in alternation, and it is recommended that only so many be used at once as are necessary to accommodate the flow comfortably. When these are choked the sewage is to be turned to another set of similar capacity. The method of using a few beds at a time, allowing them to choke quickly, and then draining them, secures the maximum percentage of rest and aeration.

STRAINERS.

The flow from the aprons is collected at the foot of the beds by channels which convey it to the centre of the group of strainers and there distribute it through gates similar to those which control the inlets to the aprons.

There are twenty strainers in all, to be used in four sets of five each. Each strainer is a brick tank, 40 by 40 feet, with concrete floor (slightly sloping towards the central drainage tunnel), upon which is placed a false floor of hollow terra-cotta floor-brick, laid with open joints, which is intended to act as a collector and drain for the water when the tank is in use, or has just been thrown out of use, and as a distributor of air when the tank is recuperating. Each tank is divided into two equal parts by a vertical diaphragm of brick, which is built upon the hollow floor-brick so that there is free communication, under the diaphragm, between the two halves of the tank. The half which receives the sewage is filled to a depth of 5 feet 4 inches with fine broken stone (½ to ¾ inch), or with coarse gravel of fairly uniform size. The other half of the tank is filled with the same material, but only to a depth of 4 feet 4 inches. The sewage, freed from its coarser solids by its passage through the apron, flows down through the deeper side of this tank, passes under the diaphragm through the hollow flooring, and rises on the other side, overflowing into a collecting channel which carries it to the aerators. The rate of flow through the strainers must be slow enough to allow the deposition of the suspended matters of the sewage upon the filtering material. A million gallons per day, passing through a set of five of the strainers provided, would travel at the rate of half an inch per minute.

When the flow is first turned into a straining tank the sewage passes through freely, and the water level in the receiving and discharging compartments is practically the same, *i.e.*, the level of the effluent overflow. As the sludge gathers, however, the service of the receiving compartment will become more and more choked, and the sewage will gradually rise, acquiring increased head as the resistance increases. When the accumulation threatens to overflow the walls of the receiving compartment, the flow of sewage is diverted to another tank, and the drainage valves in the bottom of the first tank are opened, allowing its contents to escape—slowly, so that the deposits upon the filtering material will not be washed out—into the drainage tunnel shown in the centre of section G-H, and thence through a trap into the pump-well. (This well receives nothing but the drainings of the strainers as they are thrown out of use. It is emptied, and its contents delivered to the aerators, for further treatment, by a 4-inch centrifugal pump.)

As soon as the tank is drained, so that the valves are no longer trapped by the escaping water, air, introduced into the tunnel under light pressure (say 4 oz.) by the blowers, passes into the tank and rises through the filtering material, being evenly distributed by the open-jointed hollow brick-floor. An abundance of oxygen is thus supplied, and bacterial reduction of the impurities stored in the tank is speedily set up. As the sludge on the surface of the tank dries, it should be broken up with a coarse rake, so that the rising air can escape freely, and a constant circulation be maintained. In a short time the sludge will become oxidized and disintegrated, a portion of it passed off in gaseous form and the rest being reduced to a soluble state, ready to be washed out when sewage is again passed through the tank. When this condition is reached, the tank is ready for further use, and the valves may be closed. It will be found to pass sewage as freely as when it was new, and to be capable of as much purification. If silt is kept out of the tanks, the alternate processes of accumulating and destroying the solid filth of sewage will continue indefinitely.

AERATORS.

The sewage which escapes from the discharging compartments of the strainers is free from solid filth, but it contains all, or nearly all, of its original dissolved impurities. The removal of the soluble putrescible matters is accomplished in the aerators. There are twenty of these, each 40 by 50 feet, built in the same manner as the strainers. The floor, however, slopes to the outer edges, as shown, and there is no dividing diaphragm, the sewage passing in at the top and out at the bottom.

The tanks are filled with the following materials:—(1) A layer of hollow brick, laid with open joints, as in the strainer; (2) A layer of broken stone, 5 to 8 inches thick (its bottom conforming to the slope of the filter and its top level), packed with fine broken stone at the top to support the next layer; (3) Three feet of fine washed gravel, or, better, coke crushed to pea size, with the dust screened out; (4) Six inches of broken stone, coarse at the bottom and packed with fine stone at the top; (5) Six inches of rather coarse beach sand, with a sprinkling of fine sand over it. Short lengths of agricultural drain tile pierce the sand at intervals and communicate with the top layer of broken stone, affording air vents and facilitating free circulation through the tank.

The outside walls of the aerators, shown at the ends of section K-L, are built with frequent drainage openings, arranged, as indicated in the drawings, so that they are constantly water-sealed, allowing the free passage of water but preventing the escape of air. These aerators are not to be used in sets, as in the case of the strainers, but the whole battery of them is intended to be in constant operation, the sewage trickling down in thin films over the surfaces of the particles of filtering material, while air, introduced at the bottom through the central air tunnel, is constantly rising in the voids between the particles. After they have been in use a short time, nitrification will become established, and, as long as the supply of sewage and air is reasonably constant, the purification will be continuous.

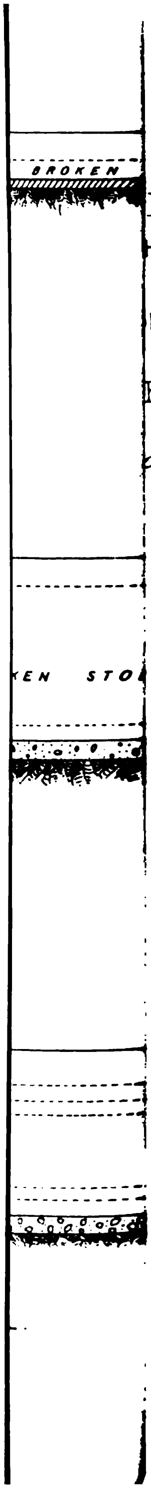
When sewage is first applied to the aerators it will sink into the sand and pass through the tank rapidly, with but partial purification.

Plan of a
ANT FOR THE PURIFICATION OF SEWAGE
BY
L OXIDATION IN ARTIFICIALLY AERATED FILTERS,
BY
George E. Waring, Jun., M.Inst. C.E.

SCALE; 1 INCH = 50 FEET.

Details of a
HE PURIFICATION OF SEWAGE
BY
N IN ARTIFICIALLY AERATED FILTERS,
BY
E. Waring, Jun., M.Inst. C.E.

CALE; 1 INCH = 8 FEET.



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HE PURIFICATION OF SEWAGE
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CALE; 1 INCH = 8 FEET.

The fine sand on the surface will speedily clog, however, and cause a slower passage and more even distribution. To secure the best results the surface of the tank should always be covered with sewage. When the accumulation is too great the fine sand may be slightly scraped; a few repetitions of this operation will remove it completely. The coarse sand will, by this time, be in condition to secure satisfactory distribution. From time to time, as scum forms on its surface, it should be slightly scratched with a very short toothed rake, say to the depth of three-eighths of an inch.

PUMPS, BLOWERS, &c.

The arrangement of pumps and blowers is as follows: Three blowers, each 72 inches in diameter and provided with an independent "direct-coupled" engine, are furnished. It is intended that one of these blowers shall supply the strainers which are undergoing aeration, that another shall feed the aerators continuously, and that the third be held ordinarily in reserve. The system of connections and gates in the power-house, however, allows the use of two or even all three blowers in supplying either aerators or strainers, and blast-gates and doors in the air tunnels permit of the concentration of the air supply upon one-half of either the strainers or the aerators. It is evident, further, that by closing the "drainage and air valves" of the different tanks, the entire blast can, if desired, be driven through one tank. The system, therefore, admits of a wide adjustment of quantity and pressure.

The experiments at Newport, U.S.A., clearly indicated that comparatively little air is actually used by the bacteria in their work of purification, but it is important that the air should penetrate to every void in which filth may be lodged, and for this reason it may be well to aerate each strainer vigorously at intervals. The pressure in the aerators must never be so strong as to make blow-holes in the top layer of sand.

The sole duty of the pump is to lift the strainer drainings into the channel which distributes to the aerators. A duplicate pump is provided, for use in case of accident.

The boilers are furnished in duplicate, each to be capable, without crowding, of running two blowers and one pump.

The efficiency of the process has been demonstrated beyond a doubt, but much remains to be learned as to its maximum capacity and economy. All the results of the Newport experiment indicate that the limit of capacity was not approached, and that the air supply was greatly in excess of what was actually needed. The size of the plant illustrated and described in the plan and sections is based upon the average rates used in the experiment. The strainers are proportioned so that each square foot receives 125 gallons of sewage per day, and in the aerators one square foot is allowed for each 25 gallons. This rate of application has been specified because it is known that it will produce, permanently, results which will be entirely satisfactory, but it is confidently believed that at least twice the amount of sewage can be purified with the same plant. Where land is valuable and the community poor, it is, of course, important that the space be as small as is consistent with safety. If necessary, the aprons may be dispensed with and the screening chamber made longer and furnished with additional fine screens. These will strain out the matters which would have been retained by the aprons, but they will cost more for maintenance, for the accumulated filth must be removed mechanically and buried, or otherwise disposed of, while in the aprons it would have been destroyed by natural agencies.

In many communities where the effluent can be turned into streams which are not used for domestic purposes or for the watering of cattle, it is not necessary to purify it to a drinking-water standard, but only to clarify it so that it will no longer be obviously offensive. In such cases aerators can be dispensed with, the effluent from the strainers being sufficiently pure for all requirements, practically as pure as the effluents from chemical precipitation processes. This will, of course, reduce materially the amount of land necessary and the cost of construction. It will obviate the necessity of pumping the strainer drainings and it will require less air and, consequently, less machinery and boiler capacity.

The expenses of maintenence will consist of the cost of fuel for running the blowers and pumps and the wages of four men,—superintendent, two engineers (day and night), and one labourer. They will be somewhat more than the expenses of managing an irrigation or filtration tract (though in the majority of cases this excess will be more than set off by the interest on the amount saved in cost of land and construction), and they will be considerably less than the operating expenses of a chemical precipitation plant of similar capacity.

As the capacity of the plant is enlarged the *per capita* cost of maintenance will diminish.

SANITATION IN THE MERCANTILE MARINE.

By W. G. Romeril.

(Associate.)

Introduction.

It is remarkable how few people except those immediately concerned have any knowledge of one common feature of the maritime life of this country, and that is the sanitation of our large mercantile fleet, which is to be found in all quarters of the globe. It is a subject that deserves attention, as it affects a class of men whose hardships and privations we daily read about, and whose death-rate compares badly with that of other dangerous callings.

> "A ship on the open sea has the solitary advantage of being surrounded by air free from terrestrial emanations. In all other respects it is placed under unfavourable circumstances, for it combines the drawbacks of inadequate crew space, of ventilation liable to frequent interruption, of a moist atmosphere acting on vegetable matters subject to decomposition. A ship in harbour, though in other respects better circumstanced, is often exposed to the most deleterious emanations from low swampy lands and rich alluvial soils. A seafaring life, moreover, is exposed to great and continuous fatigues under circumstances otherwise unfavourable to health, and to a certain extent, and often for long periods of time, to the evils of a monotonous existence. Hence the health of seamen and passengers by sea can only be preserved by the most watchful care and attention to the cleanliness, dryness and ventilation of the ship, the supply of fresh water, and of sound provisions embracing all the elements of a wholesome diet, with suitable clothes, and proper change of clothing, with fitting exercise, occupation and recreation, and facilities for separating the sick from the healthy. The precise means to be adopted to ensure these ends can only be fitly described by those who add to a general knowledge of the principles of hygiene a special acquaintance with the construction and internal economy of ships."*

The majority of shipowners are doing their best to make life comfortable on board ship, as was proved at the Sanitary Congress held at Liverpool, in September, 1894. But competition in shipping reduces the profits and causes owners to look askance at any expenditure that can in any way be avoided.

The influence of shipmasters and chief engineers with their employers might do much to mitigate many evils, but it must be borne in mind that these officers are at the best in the position of servants, and it is more to their interest to protect their employers from any additional expense. Were they to betray too great a concern for the "comfort" of their subordinates they might probably be called upon to transfer their kindhearted suggestions elsewhere.

It would be instructive to many shipowners to take a voyage to the East, *viâ* Suez Canal in a modern "tramp" steamer, at any time of the year, and see whether everything constructed of iron, and berths too near the engine room and stokeholds, are arrangements conducive to health, taking as a basis for their observations the fact that a vessel must be considered both as a dwelling and as a workshop; noting how awnings are conspicuous by their absence, and marking the conditions under which the firemen work in the stokehold, and the trimmers in the bunkers.

Crew quarters can and ought to be in such a position on a vessel as to render them habitable under ordinary conditions, and until that is done the main object from a hygienic point of view is not attained. With vessels built of all shapes and sizes, the necessity for increased sanitary supervision when in the hands of the builders is absolutely indispensable. The structural alterations ordered by Port Sanitary Authorities after the vessel leaves the builders, are frequently the fault of the Administration. Moreover, no distinction is made between vessels trading in the cool latitudes of the Atlantic, or those trading under the melting rays of a tropical sun. Again, a point frequently overlooked is this, that it costs no more in the first place to provide accommodation for crews in accordance with Sanitary laws, than to follow the contrary course.

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* Hooper's Physicians' Vade Mecum, Dr. Guy and Dr. Harley.

The ventilation and sanitation generally of engine rooms, stokeholds, and bunkers, needs more care and attention than it has hitherto received. The too common cases of "heat-frenzy," and heart-failures, demand it.

The insanitary lower forecastle is still very much *en evidence*, and in this the Danes, Scandinavians, Germans, and Dutch, are a long way ahead of the British in locating their crews above deck.

On the subject of cubic space, authorities on marine hygiene agree that the minimum space of 72 cubic feet for each man, as allowed by the Merchant Shipping Act, 1894, is not sufficient by about one-half. The shipowner is beginning to realize that fact, and in vessels outside of the passenger trade, a decided improvement in this direction is noticeable.

Drinking water at coaling stations should be under keener supervision by Port Authorities to ensure that the supply and storage is of a wholesome nature.

As to bilges these have been regarded from the earliest time as a region from whence nothing but noxious and noisome products could emanate. The sailor of romance would, if he wished to consign himself to a condition of abject abandonment, ejaculate, "May I drink bilge water!" The condition of bilges is not now vastly improved, and the day is probably far distant when for its purity bilge water will be recommended as a beverage.

Engine Room.

Notwithstanding the progress which has been made of late years in marine engineering, it is doubtful whether the sanitary conditions of engine rooms, and especially of their necessary adjuncts, the stokeholds, can be considered at the present time to have advanced at a similar rate. In the case of many vessels the contrary would appear to be the case. Economy of space here, as in all other parts of a ship, has the prior claim in construction. This point conceded, it becomes necessary to so study the spaces allotted to those who control the machinery and furnaces, that the highest possible degree of sanitation may be secured. A step in the right direction has been taken by the Institute of Marine Engineers in the discussion of papers on Ventilation. It is to be hoped they will persevere in endeavouring to remedy evils which are sufficiently obvious to those employed. The intense heat is naturally one of the greatest discomforts to be borne in engine rooms, and particularly now that increased steam pressures are being so largely introduced. Little attention also appears to be paid to the proper insulation of back ends of boilers (abutting on divisional bulkhead), cylinders, and steam-pipes. The lower platforms are frequently cramped by side-pockets and storerooms, and efficient ventilation is in almost all cases overlooked.

Now that coal consumption is better understood, and in view of the economy thus effected, it becomes an open question whether side-pockets and lower bunkers should occupy any important place in the construction of engine rooms and stokeholds, or whether indeed they are needed at all. If they are not needed, more air space would be available and ventilation thereby improved.

The common practice is to have the entire system of ventilation in the immediate vicinity of funnels and boilers, a course which is open to many objections, not the least important of these being the fact that with the wind at certain angles the ventilators become practically useless. The question therefore arises whether, with all the mechanical aids to ventilation at our disposal, these large cowl obstructions are required. It is without a doubt necessary to have large and efficient air shafts for intake ventilators, but proper egress must be provided for the imprisoned hot air, in order that a circulating system of ventilation, not liable to interruption, may be maintained. For vessels trading in hot climates, ventilation by propulsion or extraction would appear the most effective method, for it not only guarantees a sufficient air supply, but also assists in reducing the temperature.

The cramped space round and about machinery is not consistent with the proper diffusion of air, and the necessarily greasy bilge is in direct opposition to the laws of health. These are matters that could be remedied without incurring any further expense. Side pockets, if absolutely necessary, might be sloped down to the vessel's side to about 10 ft. above the lower platforms. A greater width should be given to the engine hatch, with more and larger openings into alleyways, and a skylight running the whole length.

The insulation of boilers (not omitting donkey boilers), steam pipes, and cylinders, with non-conducting material, is a point which would not only conduce to the lowering of the temperature of the surrounding atmosphere, but also assist in maintaining a high internal temperature, with a probable saving of fuel.

Engine room bilges being easier of access are better adapted to cleansing than the bilges in other parts of the vessel. Yet it must be admitted that the frequent purification of these is a custom more honoured in the breach than in the observance. This may be due to an idea prevalent among many people that most smells should be treated with "disinfectants." The sooner such ideas give way to habits of real cleanliness the better it will be for all concerned.

It may, however, be taken for granted that, notwithstanding the most favourable conditions, sanitation will not prevail unless there be a local system of supervision, exercised and enforced by engineers, to ensure proper means being taken towards mitigating evils always present in these places, discipline being an important factor in promoting a high standard of excellence.

STOKEHOLDS.

Little improvement appears to have been made in stokeholds of the present day with regard to matters affecting the well-being of the men employed there, for the simple reason, that beyond engineers and those immediately concerned, few persons, if any, think of going near these remote and gloomy recesses in search of insanitary conditions.

The usual routine, when the vessel is under steam, is for the stokers, or as they are generally termed, firemen, and trimmers to keep what is called "three watches," that is four hours on and eight hours off duty.

In port the duties differ, for in that case some are "told off" to work in engine room, the hours of duty being usually from 7 a.m. to 5 p.m., with intervals for meals.

Both stokeholds and bunkers may be considered "workshops," where men are constantly feeding and cleaning fires and trimming coal. These fires are attended to from a platform, three to five feet above the vessel's bottom, the most notable feature of which is its cramped and confined position and area.

It can be understood that places so low down in the ship must in all cases be difficult to ventilate. The conditions, however, vary in some degree in almost all vessels, owing to the fact of few being built on exactly the same lines.

As in the case of engine rooms, but if anything in a more marked degree, abnormal heat is the most unfavourable condition under which the men labour. High steam pressure means a corresponding increase of temperature in the vicinity of boilers, and the need for keener vigilance is apparent as, up to the present time, sanitation in those places has been but a secondary consideration.

The following remarks by an eminent authority on the question of temperature will be of interest.

> "One of the most remarkable facts in connection with man is, that when in health he is able to maintain his normal or standard body heat of 98° to 99° F. under the most extreme and opposite climatic conditions. This of course is not always the case, for at times both extreme cold and heat profoundly affect man's physiological condition. Except perhaps in the tropics, the general effect of direct sun's rays on the body is beneficial; but prolonged exposure to great heat, whether in the sun or in the shade, is accompanied by pronounced physiological disturbance. Some experiments go to show that the body heat itself is increased $\frac{1}{25}$ degree for each degree (Fahrenheit) rise in the air's temperature, while the respiration of those living in hot countries, though at first (some six months) increased, are afterwards so much lessened in frequency that the entire respiratory function is reduced by about 18½ per cent. Much of this lessened respiratory function in hot climates is said to be due to the fact that with a high temperature the quantity of oxygen present in the air is diminished. Thus a cubic foot of dry air at 32° F. weighs 566·85 grs., which, neglecting the slight amount of carbon dioxide present, gives in that cubic foot of air 436·5 grs. of nitrogen and 130·35 grs. of oxygen. Assuming that a man at rest breathes 16·6 cubic feet of air per hour into his lungs, he will at 32° F. receive 2,164·2 grs. of oxygen per hour. At a temperature of 100° F. (which is not unusual in tropics) a cubic foot of dry air weighs 498 grs., and is made up by weight of 383·5 grs. of nitrogen and 114·5 grs. of oxygen. Therefore in an hour, breathing as before, the man would receive 1,901 grs. of oxygen, or nearly 12 per cent. less than he would breathe in at the lower temperature. The action of the skin is increased in hot countries by as much as 24 per cent., but the water exhaled by the breath, and passed off by the kidneys, is proportionately reduced. In hot climates the general functions of the whole body become

impaired, notably the nervous system and digestive organs, which, from being the seat of more or less increased action, are peculiarly liable to become congested and enlarged. The essential requirements for the bearing of great heat by the body is the maintenance of abundant perspiration; the moment this fails the heat equilibrium is disturbed, and the body heat rises rapidly, accompanied sooner or later by insensibility and death from heat-stroke." *

Without a doubt abnormal heat is the firemen and trimmers' greatest foe. It will vary in different vessels, there being no uniformity in construction, and according to the method of ventilation adopted. In a measure also it will depend on the type of boiler, but the following remarks will apply to nearly all cases:—

When the direction of the wind is at right angles, or in a line with the ship, that is abeam or abaft, ventilators of the cowl variety are next to useless, consequently the little air that can be obtained is by induced currents, and is all that can be relied upon. Under these conditions, for men to remain stoking four hours without going on deck may be possible in high latitudes, but it is practically impossible to do so in hot climates, when the temperature is between 110° to 140° F. It is a common occurrence for the men to go on deck after every "fire up" for fresh air, in a half-exhausted state, and in clothes dripping with perspiration, to encounter a difference of temperature of from 30° to 60°. Under these circumstances the same rate of speed cannot be maintained as when the men might remain below, it being well known that there is a difficulty in keeping up the proper amount of steam when these conditions exist.

When the wind is blowing in a direction opposed to that of the ship, that is ahead and before the beam, firemen are able to remain below by standing immediately beneath the ventilators. This they do after stoking the fires, or as it is termed "firing up," an operation which occupies four or five minutes, thus exposing themselves in their enervated condition to a greater difference of temperature than by going on deck, a proceeding which cannot but be deleterious to health. In the side bunkers, and particularly the lower ones, the heat from boilers is invariably greater than the heat in stokeholds. Here again may be noticed the want of efficient ventilation, so that, what with the dirty nature of their work, the trimmers' lot is if anything worse than the firemen's.

Fig. 1 (page 88) represents the stokehold of a new vessel of about 4000 tons, employed in the foreign trade. Having two high pressure boilers, (*a*) (*a*), Fig. 1. Depth of hold from fiddlee (*b*) (*b*), Fig. 1, to lower platform (*c*) is about 40 ft. This place is ventilated by two 24" ventilators (*d*) (*d*), situated in the space between the funnel (*e*) and stokehold bulkhead (*f*), Fig. 2, which at the opening in fiddlee (*g*), Fig. 2, is 12 ft. by 4 ft. This space is intersected at certain altitudes by iron gratings, (*h*) (*h*) Fig. 2. The egress for the hot air is by the funnel cape, (*i*) (*i*) Figs. 1 and 2, and two 12" ventilators, (*k*) Fig. 2, abaft the funnel; this being totally inadequate, and better means could have been provided without affecting the question of seaworthiness. Four of the furnaces, (*l*) Fig. 1, being 4 ft. 6 in. above the platforms, will consequently entail more work for the men, a fact well worth considering, because under the most favourable conditions the exposure to the immediate vicinity of the radiant heat cannot be entirely remedied. Again, the labour of the men will be further enhanced by the quality of the coal used; with Japanese and other Eastern coal, fires require frequent tending and more coal. The products of combustion will be increased, and consequently more ashes to heave up at the end of the watch.

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* Hygiene by Prof. Notter and Surg.-Major Firth.

Fig. 3 represents the engine room and stokehold of a vessel of about 1000 tons, employed in the coasting trade of this country, with a depth of hold of about 22 ft. from the fiddlee to the lower platform, the space between the furnaces and stokehold bulkhead being about 7 ft. 5 in. This place is ventilated by two 27" cowl ventilators; and whether these will always prove effective and sufficient in admitting fresh air into the stokeholds under all conditions, except with the wind ahead or before the beam, is a question which may be answered in the negative. The exception indicated is their only commendable point, and it cannot be said that they will even then cause a proper diffusion of air in all parts of the stokehold; consequently this means of ventilation cannot be relied upon. In the first place, there is too little space on the platform, the ventilators are too near the funnel and boiler, and the egress, (*a*) Fig. 3, for the hot air is inadequate.

Representing, as this diagram does, the average vessel in the coasting trade, where the temperature in the stokeholds in the summer months is between 100° and 125° F., and where there is only one fireman on watch at a time, who has to do both the trimming and stoking, it can well be understood that work carried on under these circumstances must be a great strain on one man.

Good ventilation goes a long way in making a cool stokehold, but at present unfortunately it is only partial and ill-directed.

Fig. 4 illustrates the method in vogue of utilizing ventilators for the purpose of raising ashes from the stokehold, a practice which is open to condemnation on account of obstruction.

The inlet of stokehold ventilators, in some cases, are at times screened by bridge obstructions (see Fig. 5) in the shape of dodgers, awnings, and screens, a state of things which tends to nullify any attempt at ventilation.

The absence of sufficient space on lower platforms will in a great measure account for the close atmosphere common to all stokeholds. The lower side bunkers (*a*) (*a*), Fig. 6, take up too much room; but if, as in the same Fig. 6, they were sloped down from between decks to the vessel's side, *i.e.*, from (*b*) to (*c*), no great sacrifice of bunker accommodation would be made, and it would provide sufficient means for getting round boilers, thus assisting the circulation of air. In addition the bare sides of the vessel would tend to reduce the temperature. There should be at least 10 ft. space between furnaces and bulkheads or bunkers, and sufficient space above the uptake of

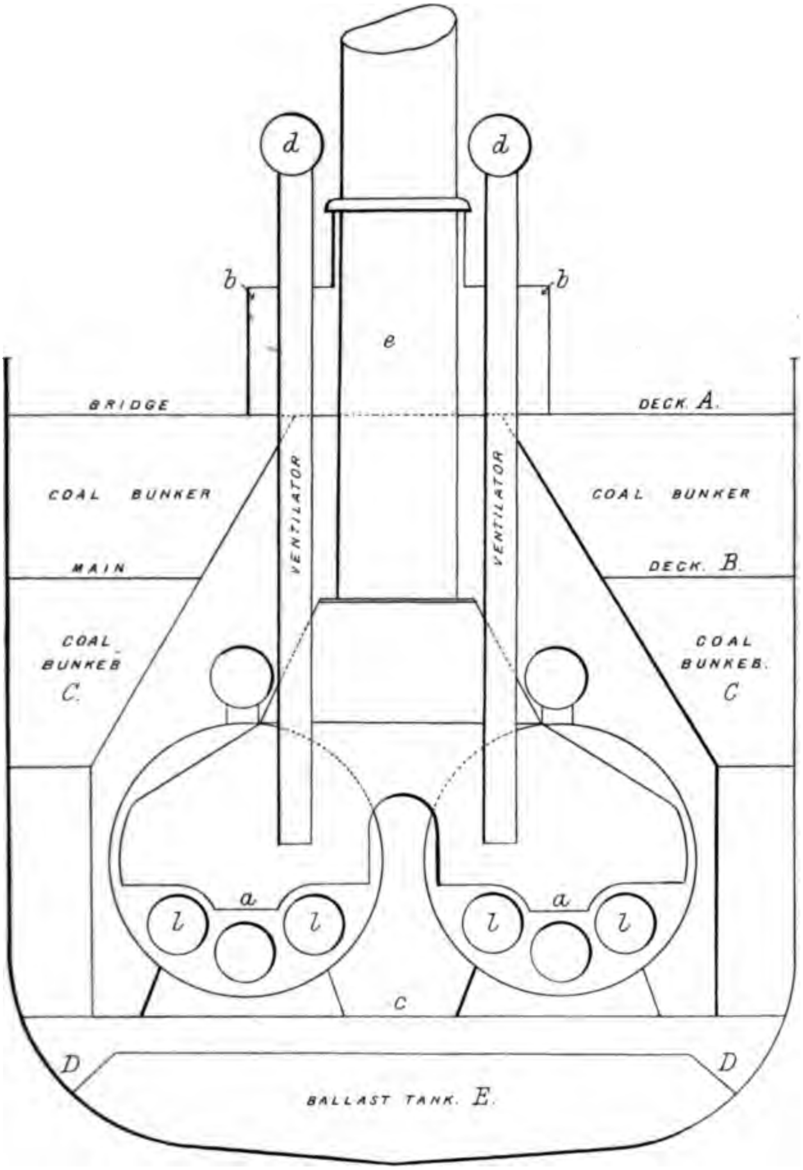

FIG I. TRANSVERSE SECTION THROUGH STOKEHOLD.
(LOOKING AFT).

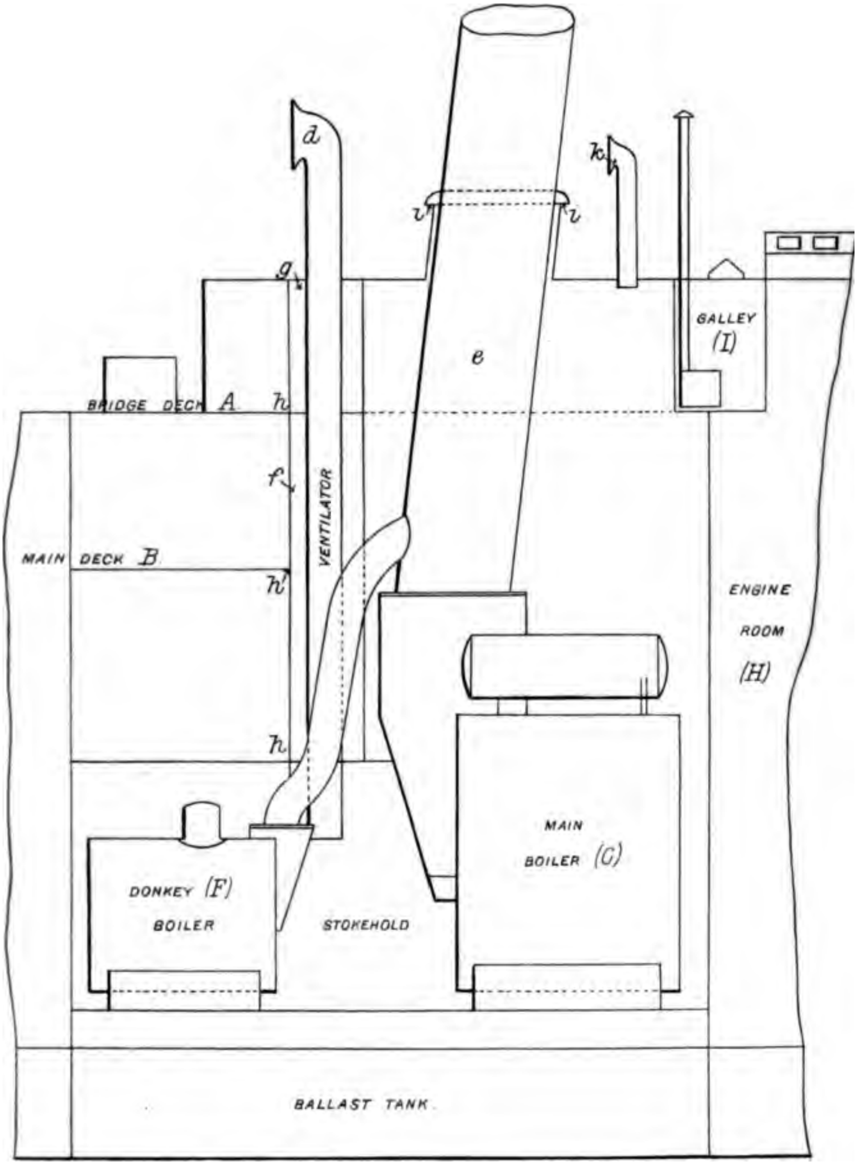

FIG. 2. SECTION OF STOKEHOLD. — FORE AND AFT.

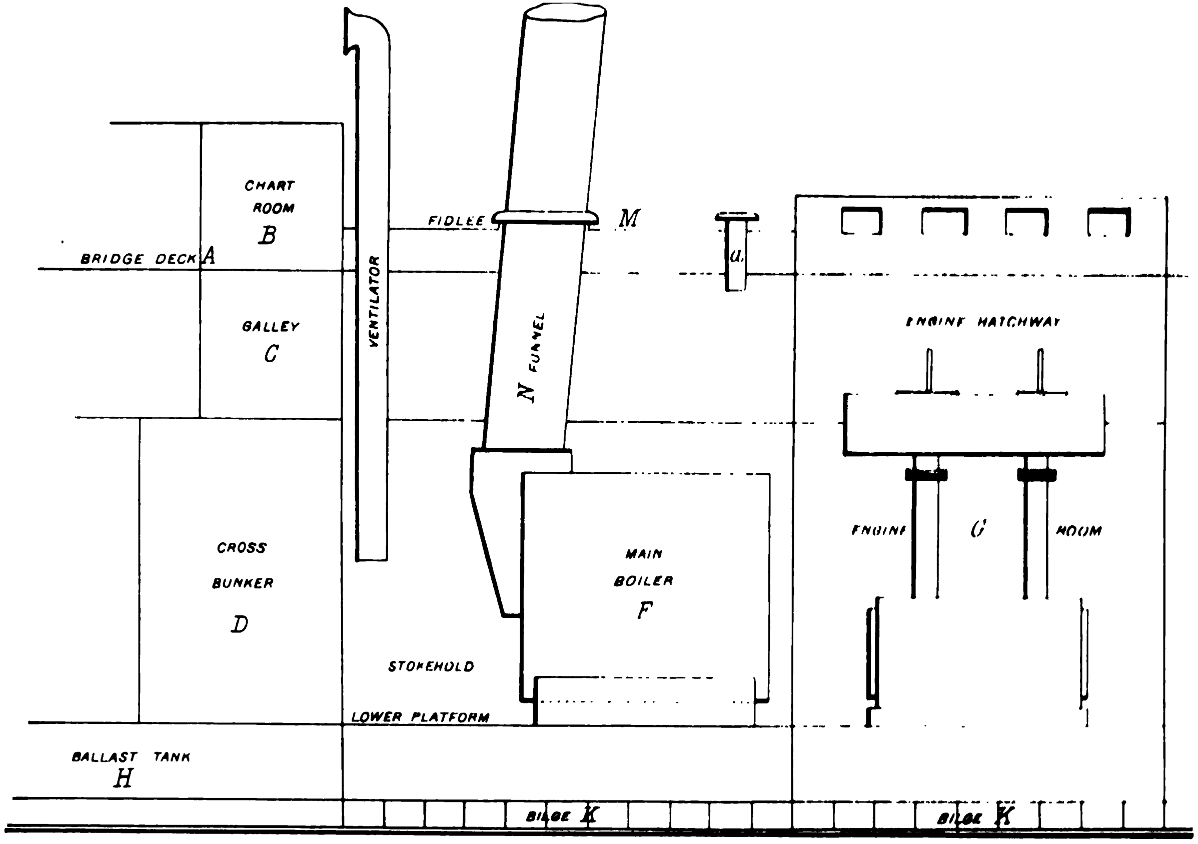

FIG 3 SECTION SHOWING STOKEHOLD &c

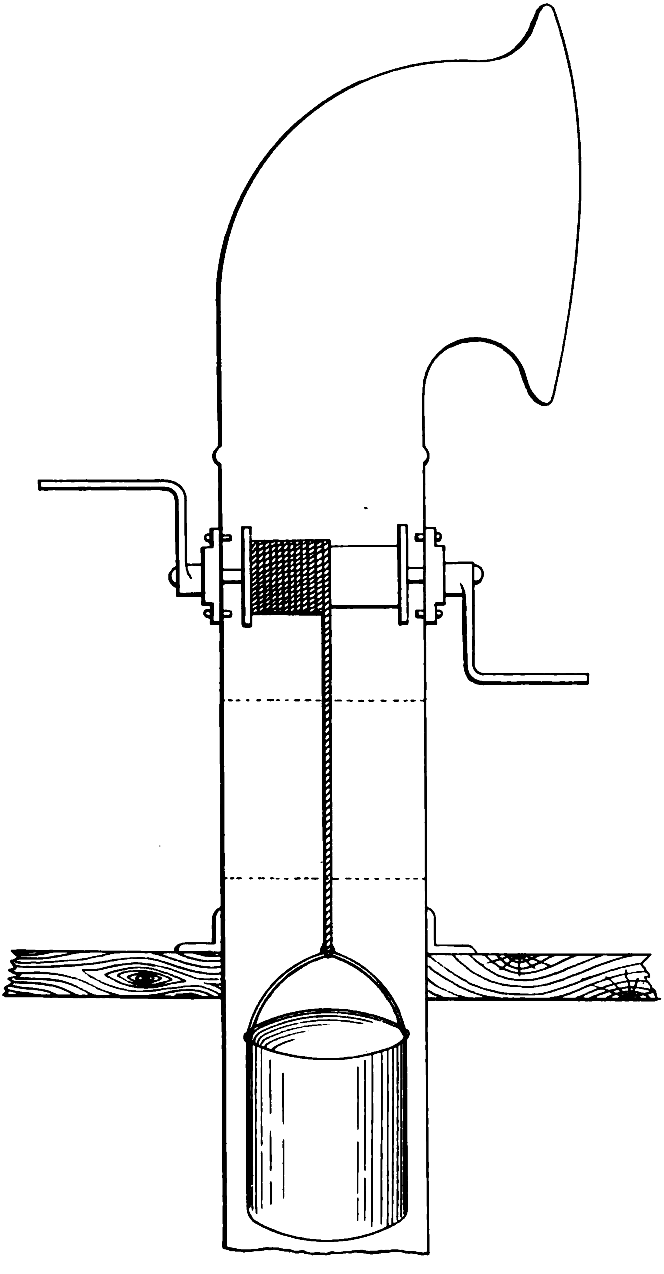

FIG 4

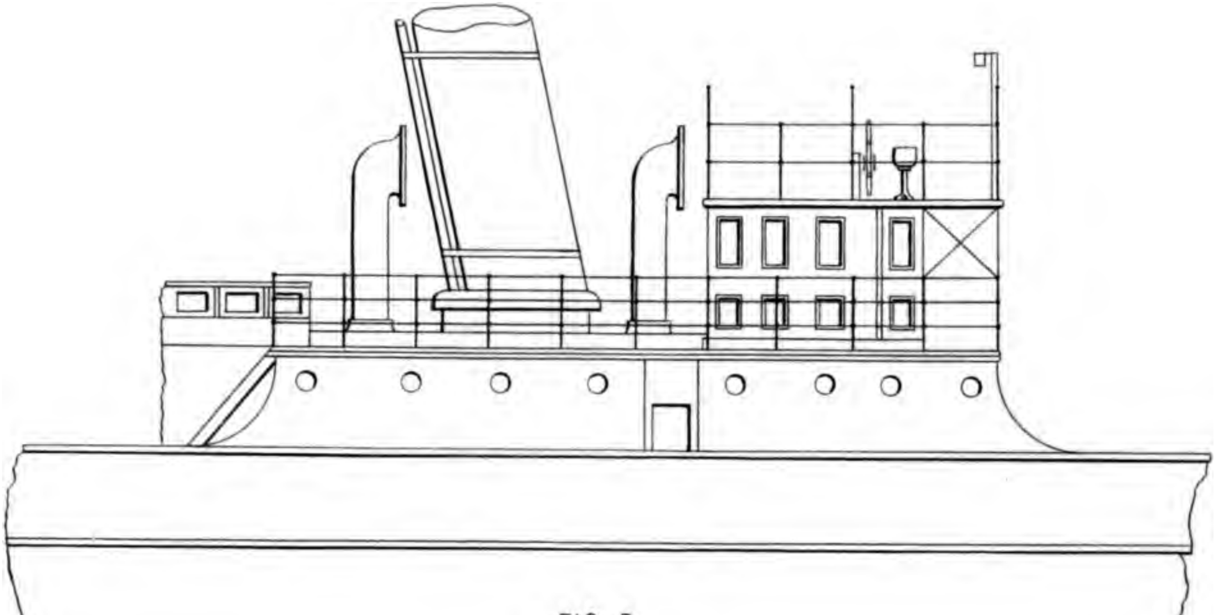

FIG 5

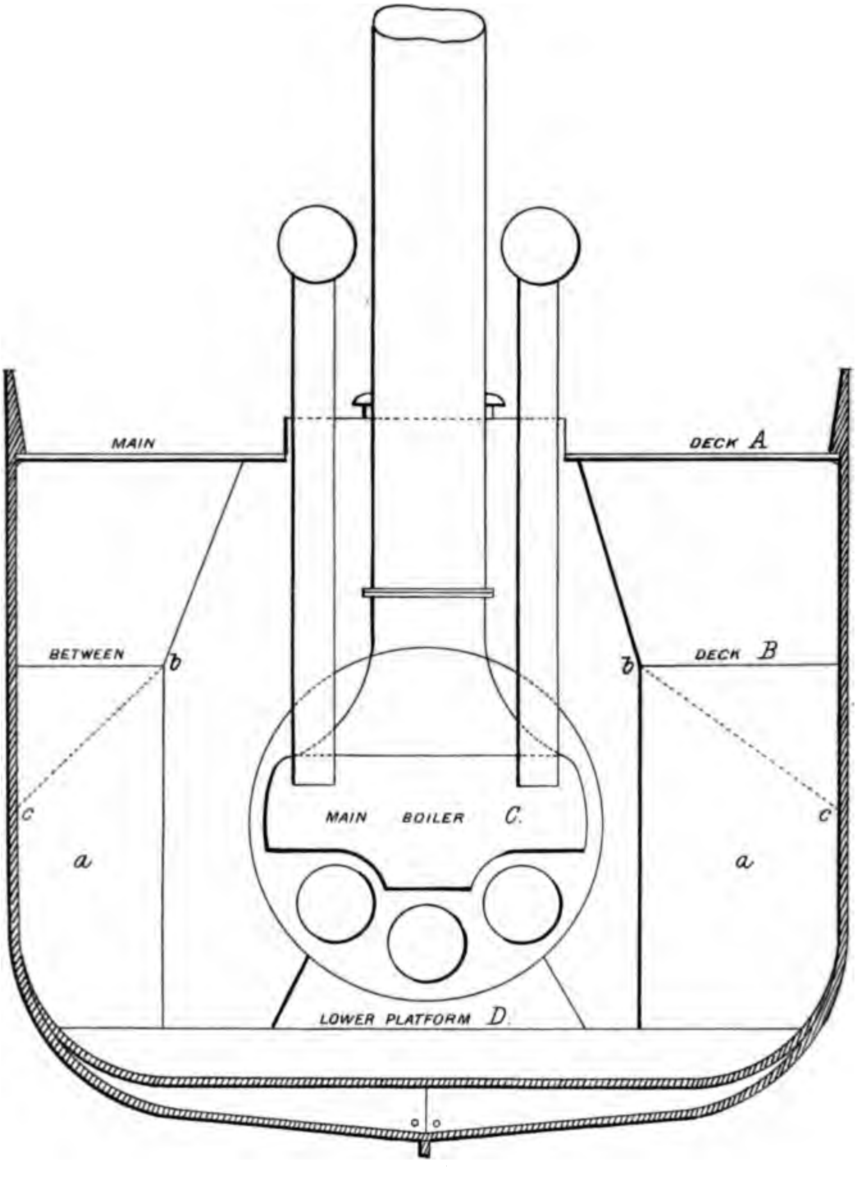

FIG 6 TRANSVERSE SECTION OF STOKEHOLD.
(LOOKING AFT).

boilers, so that the escape of hot air should be facilitated in every possible way. Periodical limewashing, say once every six months, would assist in some measure in keeping the air of the place sweet.

The position of the bilges differs considerably. In some vessels they will be found immediately below the platform, as in Fig. 6, where they can be got at at all times, whilst in others with ballast tanks they are at the sides, Fig. 1 (*d*) (*d*), in which case they are under bunkers, and consequently not easy of access.

With regard to the sources of pollution, these are common to all vessels, and few people but those immediately concerned have any idea how foul the bilges become. No doubt lack of proper and systematic supervision leads to a serious nuisance, viz., the frequent abuse of the stokehold as a urinal by those employed there. The urine finds its way to the bilges, and it is time decisive steps were taken to put a stop to this practice. Another source of pollution is soap-suds, the results of personal ablutions and washing clothes. Such water soon becomes foul, and it is evident that this must be classed as the source of a serious nuisance. Then again the residue of oil from engines, works itself into grease balls, which become putrid and add to the nuisance. Side bilges are said to be more foul than others, and this no doubt is mainly due to the fact of their being under the bunkers and not easy of access.

A few words about a class of men who in many instances have fallen a prey to their work, as a study of the return of deaths issued monthly by the Registrar-General of shipping and seamen reveals, will perhaps be of interest. The world at large knows little about them, and as a rule they receive but scant sympathy from the nautical fraternity, otherwise more vigorous sanitary reform would be manifest.

It may be true in most cases that the firemen and trimmers are composed of men who have been forced to take to this work for want of other employment. Still there is no doubt that a large number are attracted to it by the wages, which are higher than those paid to sailors, a point worthy of note as showing that the duties are recognised as being more arduous, or even more dangerous; but their work cannot be considered more *important* than that of the deck hands, who have to steer and keep a look-out. Physically there is no difficulty in picking them out from other members of the crew, as they carry the impress of their calling in their emaciated and frequently exhausted appearance.

(To be continued.)

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* In speaking of "the bilges" here, it must be understood that it is intended to indicate those parts of a vessel where waste liquid matters from the interior finally lodge. Technically the "bilge" of any vessel is a certain defined area, the position of which is invariable.

MEETINGS HELD JANUARY TO MARCH, 1896.

ORDINARY GENERAL MEETING.

The Ordinary General Meeting was held on March 25th. The Annual Report and Statement of Accounts for 1895 were submitted. The Report, which is published on page 55, gives an account of the various branches of work undertaken by the Institute; and in consequence of the large number of Committees to which the work of the Institute has to be allotted, it was moved on behalf of the Council, and resolved, that the elective members of Council be increased by four. It will now consist of thirty-one members, and the President and Vice-Presidents.

According to the regulations of the Institute, His Grace the Duke of Westminster, who has been President for the past three years, was not again eligible for re-election, and the Chairman reported that His Royal Highness the Duke of Cambridge had graciously consented to accept the Presidentship.

The following Officers and Members of Council were elected or re-elected:—

As Vice-Presidents.

Right Hon. EARL FORTESCUE.
Right Rev. F. TEMPLE, D.D. (Bishop of London).
Sir F. ABEL, Bart., K.C.B., D.Sc., D.C.L., F.R.S.
Sir HENRY W. ACLAND, Bart., K.C.B., M.D., D.C.L., LL.D., F.R.S.
Sir DOUGLAS GALTON, K.C.B., D.C.L., LL.D., F.R.S.
Sir G. M. HUMPHRY, M.D., D.Sc., F.R.S.
Sir W. GUYER HUNTER, K.C.M.G., Q.H.S., M.D., LL.D., F.R.C.P.
Sir FRANCIS SHARP POWELL, Bart., M.P.
Sir ROBERT RAWLINSON, K.C.B., M.Inst.C.E.
Sir J. RUSSELL REYNOLDS, Bart., M.D., F.R.C.P., F.R.S.
Sir HENRY THOMPSON, Bart., F.R.C.S., M.B.
A. WATERHOUSE, R.A., LL.D.

As Members of Council.

LEWIS ANGELL, M.Inst.C.E., F.R.I.B.A.
Prof. W. H. CORFIELD, M.A., M.D.
ROGERS FIELD, B.A., M.Inst.C.E.
H. R. KENWOOD, M.B., L.R.C.P., D.P.H.
BALDWIN LATHAM, M.Inst.C.E.
E. G. MAWBEY, Assoc.M.Inst.C.E.
R. E. MIDDLETON, M.Inst.C.E.
Prof. J. LANE NOTTER, M.A., M.D.
ROWLAND PLUMBE, F.R.I.B.A.
J. OSBORNE SMITH, F.R.I.B.A.
J. F. J. SYKES, D.Sc., M.D.
FRANCIS VACHER, F.R.C.S.

As Treasurer.

Sir DOUGLAS GALTON, K.C.B., D.C.L., LL.D., F.R.S.

As Auditors.

MAGNUS OHREN, Assoc.M.Inst.C.E.
ALFRED LASS, WOOD & Co.

A sincere vote of thanks was passed to His Grace the Duke of Westminster for the assistance that he had given to the work of the Institute, and a vote of thanks also to the Vice-Presidents, Council, and Officers.

SESSIONAL MEETINGS.

A meeting was held on February 12th when a discussion was opened by S. Monckton Copeman, M.A., M.D.Cantab, M.R.C.P., on "The Influence of Subsoil-Water on Health." Dr. R. Farquharson, M.P., in the chair. About 76 Members, Asssociates, and Visitors attended.

On March 11th a discussion was opened by Augustus C. Scovell, J.P., Chairman of the Ambulance Committee of the Metropolitan Asylums Board, on "The Isolation of Cases of Infectious Diseases in the Metropolis. R. Thorne Thorne, C.B., M.B., F.R.C.P., F.R.S., in the chair. About 80 Members, Associates, and Visitors attended. Both the papers and discussions are printed in this Journal, see pages 23 & 43.

LECTURES AND DEMONSTRATIONS TO SANITARY OFFICERS.

The Twenty-first Course of 18 Lectures and 20 Practical Demonstrations and Visits of Inspection to trade premises, Refuse Disposal Works, commenced on February 17th. 73 Students entered their names for this course.

As a Supplement to the Lectures, the Council arranged some Practical Demonstrations on Meat Inspection and Diseases of Animals, which were conducted by W. A. Bond, M.A., M.D., D.P.H., Medical Officer of Health, Holborn and St. Olave's, Southwark.

EXAMINATION.

Examination for Inspectors of Nuisances.—An Examination was held at Plymouth on January 17th and 18th. 7 candidates presented themselves, and 6 were certified to be competent as regards their sanitary knowledge to discharge the duties of Inspectors of Nuisances. The following questions were set to be answered in writing on the 17th, and the candidates were examined *vivâ voce* on the 18th.

1.—What statutory powers have Local Authorities with regard to cubic space and ventilation? Name the Acts by which these powers are given.

2.—What powers has an Inspector to deal with nuisances arising from—

(*a*) Refuse from a dwelling-house;
(*b*) Smoke;
(*c*) Defective drainage.

3.—Describe the trades of Gut-scraping and Brick-burning; what precautions are necessary in each of these trades to prevent nuisance arising, and what powers have Sanitary Authorities to enforce these precautions?

4.—It is proposed to utilize the water from a small brook to supply a village; state what you would do to ascertain whether the water was fit for the purpose.

5.—Mention some of the contagious diseases of cattle which are communicable to man. Describe exactly the measures you would recommend to be taken in the event of an outbreak of one of these diseases amongst the cattle in a cowshed.

6.—What are the diseases compulsorily notifiable under the Infectious Diseases Notification Act, 1889? State briefly, in regard to each disease, what is the nature of the illness which characterizes it, and what are the principal sources of dissemination of infection from the patient's body?

7.—Describe the best method of removing foul air from, and of admitting fresh pure air into, ordinary dwelling-rooms.

8.—Explain how a Dairy and a Slaughter-house should be drained, and illustrate your explanation by sketches.

9.—Describe some of the different kinds of Water-closets commonly used in large Day-schools. State which kind you consider the best, and give your reason. What precautions are necessary to prevent nuisance from the use of closets in schools?

ALTERATION IN BY-LAWS OF THE INSTITUTE.

The attention of the Members is called to the following alterations that have been made in the By-Laws of the Institute. Clauses 31 and 32 now read as follows:—

31.—A Board of Examiners shall be elected annually by ballot by the Council from among the Fellows of the Institute. Notice of the meeting at which the election will take place with the names proposed shall be sent to each Member of the Council not less than six days previous. One-fourth of the Examiners shall be ineligible for re-election for one year.

32.—A Certificate shall be awarded to all successful candidates in the form prescribed by the Council. The Certificate shall be under seal and bear the name of the Examiners and be signed by the Chairman of the Council and by the Registrar.

FORTHCOMING MEETINGS.

CALENDAR, APRIL TO JUNE, 1896.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.*

Finance Committee . . .	Second Wednesday at 4 p.m.
Exhibition Committee . . .	First Tuesday at 5 p.m.
Congress and Editing Committee .	Second Monday at 5.15 p.m.
Education Committee . . .	Third Monday at 5 p.m.
Museum and Library Committee .	Fourth Monday at 5 p.m.

* The Council Meeting in April will be held on the 15th.

APRIL.

1 W. Inspection and Demonstration at L.C.C. Common Lodging House, Parker Street, Drury Lane, conducted by Frank J. Ruddle, P.A.S.I.

3 F. *Good Friday.*

6 M. *Easter Monday.*

9 T. Lecture to Sanitary Officers at 8 p.m. Details of Plumbers' Work, by J. Wright Clarke.

10 F. } 11 S. } Examination for Inspectors of Nuisances, Birmingham.

11 S. Inspection and Demonstration at the Beddington Sewage Farm, Croydon, conducted by Thomas Walker, M.INST.C.E.

13 M. Lecture to Sanitary Officers. Sanitary Appliances, by George Reid, M.D., D.P.H.

15 W. Inspection and Demonstration at East London Water Works, Lea Bridge, conducted by W. B. Bryan, M.INST.C.E.

15 W. Sessional Meeting at 8 p.m. Discussion, to be opened by J. F. J. Sykes, D.SC., M.D., on The Factory and Workshops Acts, and the Powers and Duties of Sanitary Authorities with regard to Workshops.

16 T. Lecture to Sanitary Officers at 8 p.m. House Drainage, by W. C. Tyndale, ASSOC.M.INST.C.E.

18 S. Inspection and Demonstration at the Sewage Outfall Works, Barking, conducted by J. E. Worth, M.INST.C.E.

20 M. Lecture to Sanitary Officers at 8 p.m. Sewerage and Sewage Disposal, by Prof. Henry Robinson, M.INST.C.E.

22 W. Inspection and Demonstration of Artisans Dwellings in the Boundary Street Area, Bethnal Green, conducted by Mr. Owen Fleming.

24 T. Lecture to Sanitary Officers at 8 p.m. Scavenging. Disposal of House Refuse, by C. Mason, ASSOC.M.INST.C.E., A.R.I.B.A.

25 S. Inspection and Demonstration at Sewage and Destructor Works, Ealing, conducted by C. Jones, M.INST.C.E.

27 M. Lecture to Sanitary Officers at 8 p.m. Principles of calculating Areas, Cubic Space, &c.; Interpretations of Plans, and Sections to Scale' by J. Wallace Peggs, ASSOC.M.INST.C.E.

MAY.

8 F } 9 S. } Examinations in Practical Sanitary Science and for Inspectors of Nuisances, London.

JUNE.

5 F. } 6 S. } Examination for Inspectors of Nuisances, Newcastle-upon-Tyne.

JULY.

10 F. } 11 S. } Examination for Inspectors of Nuisances, Cardiff.

FELLOWS, MEMBERS, AND ASSOCIATES ELECTED.

From January to March, 1896, inclusive.

FELLOWS (Fell. San. Inst.)

770 1896. Mar. Mason, Charles, ASSOC.M.INST.C.E., A.R.I.B.A., *Town Hall, Charing Cross, W.C.*

513 1896. Feb. Thursfield, William Nealor, M.D., *County M.O.H. for Shropshire, Shrewsbury.*

318 1896. Mar. Tyndale, Walter Clifford, ASSOC.M.INST.C.E., *Horse Guards, Whitehall, S.W., (St. Stephen's Road, Ealing.)*

MEMBERS (Mem. San. Inst.)

‡ **Passed Examination as Inspector of Nuisances.**

* **Passed Examination in Practical Sanitary Science.**

945 1896. Jan. ‡Boyd, Andrew, B.E., 48, *Church Street, Ballymena, Ireland.*

946 1896. Jan. *Collins, Arthur Walter, 172, *High Street, Peckham.*

959 1896. Feb. Defries, Wolf, B.A.LOND., M.INST.M.E., 147, *Houndsditch, E.*

949 1896. Jan. Ferrand, Surgeon Lieut.-Col. Edward, M.D., D.P.H., 6th M.I., *Bherampore, Madras.*

960 1896. Mar. Garrett, Henry Augustus, ASSOC.M.INST.C.E., *Town Hall, Torquay.*

961 1896. Mar. Hendry, James Stevenson, *Borough Surveyor's Office, Town Hall, West Bromwich.*

947 1896. Jan. *King, Claude, 24, *Prince of Wales Road, Norwich.*

950 1896. Feb. *King, Frederick William, *Heybridge, Maldon, Essex.*

951 1896. Feb. Lane, Harry Angel, D.P.H.(CANTAB.), *Holbeach, Lincolnshire.*

948 1896. Jan. *Law, James, Lieut. and Quartermaster R.E., *Stanley House, Netley Street, Farnborough, Hants.*

952 1896. Feb. *Moyse, W. G., 3, *Lyme Street, Camden Road, N.W.*

953 1896. Feb. *Narramore, William, F.L.S., 5, *Geneva Road, Elm Park, Liverpool.*

954 1896. Feb. Norris, W. Perrice, D.P.H.(LOND.), 772, *Drummond Street, North Carlton, Victoria, Australia.*

962 1896. Mar. *Parham, John, 5, *Edison Road, Crouch End, N.*

955 1896. Feb. *Parry, Joseph William, ASSOC.M.INST.C.E., 31, *Beverley Road, Annerley, S.E.*

963 1896. Mar. Pickering, Joseph Spiers, ASSOC.M.INST.C.E., *Town Surveyor, Nuneaton, Warwick.*

964 1896. Mar. Scott-Moncrieff, Major George Kenneth, R.E., ASSOC.M.INST.C.E., *Brompton Barracks, Chatham, Kent.*

944 1896. Jan. Stamford, Earl of, 2, *Whitehall Court*, *S.W.*
956 1896. Feb. Watson, Thomas, assoc.m.inst.c.e., *Perth*, *Western Australia.*
957 1896. Feb. *Wilkinson, Charles Edward, 41, *Fabian Road*, *Fulham*, *S.W.*
958 1896. Feb. Willoughby, William George, m.d.(lond.), d.p.h. (cantab.), "*Kingston*," *Lewes Road*, *Eastbourne.*

ASSOCIATES (Assoc. San. Inst.)

‡ Passed Examination as Inspector of Nuisances.

1276 1896. Feb. ‡Ablett, Joseph Henry, 18, *Hubert Street*, *Birmingham.*
1288 1896. Mar. ‡Adams, Herbert, 43, *Thornhill Road*, *Barnsbury*, *N.*
1289 1896. Mar. ‡Adams, Richard, 6, *Shaw Street*, *Quarry Bank Road*, *Birkenhead.*
1233 1896. Jan. ‡Andrews, Samuel Percy, 25, *Castle Street*, *Hertford.*
1290 1896. Mar. ‡Barnes, Arthur Edward, 64, *Belford Street*, *Burnley*, *Lancashire.*
1245 1896. Jan. ‡Bird, Miss Isabel Jean, 11, *Leathwaite Road*, *Clapham Common*, *S.W.*
1291 1896. Mar. ‡Bradshaw, Timothy, 323, *Bolton Road*, *Pendlebury*, *Lancashire.*
1292 1896. Mar. ‡Bugg, William George, 17, *Kieldon Road*, *Battersea Rise*, *S.W.*
1277 1896. Feb. ‡Bull, Joseph H., 2, *The Acacias*, *Morland Road*, *Croydon.*
1268 1896. Feb. ‡Carver, William, *Wretton*, *Stoke Ferry*, *Norfolk.*
1262 1896. Jan. ‡Clarke, George, 6, *Burn Hill Road*, *Beckenham.*
1293 1896. Mar. ‡Collingwood, T. A. J. T., *Coalville*, *Leicester.*
1275 1896. Feb. ‡Collins, Edwin Richard, 4, *Pembroke Villas*, *Underhill Road*, *East Dulwich*, *S.E.*
1269 1896. Feb. ‡Cook, Christopher Berney, 31, *Wellington Square*, *S.W.*
1234 1896. Jan. ‡Cornell, Arthur, *Hainault Road*, *Romford.*
1264 1896. Jan. ‡Day, Alfred Matthew, 41, *Pigott St.*, *Limehouse*, *E.*
1270 1896. Feb. ‡Dickinson, Isaac William, 7, *Cheltenham Villas*, *Middle Road*, *Bournemouth.*
1294 1896. Mar. ‡Egginton, Thomas R., 176, *Waterloo Road*, *Cape Hill*, *Birmingham.*
1271 1896. Feb. ‡Ellis, Robert Herbert, 33, *Roding Road*, *Homerton*, *N.E.*
1279 1896. Feb. ‡Ellson, Joseph, *Greaves Street*, *Ripley*, *Derbyshire.*
1280 1896. Feb. ‡Firth, James E., 7, *Randolph Street*, *Haley Hill*, *Halifax*, *Yorks.*
1295 1896. Mar. ‡Firth, William, 10, *Shrubland Road*, *Dalston*, *N.*
1235 1896. Jan. ‡Fleck, John Robert, 164, *Eversleigh Road*, *Lavender Hill*, *S.W.*

1216 1896. Jan. ‡Fricker, E. W., 19, *St. Stephen's Mansions, Westminster, S.W.*
1236 1896. Jan. ‡Fryer, Henry Newton, 3, *Shakespeare Villas, Grays, Essex.*
1237 1896. Jan. ‡Gordon, Harry, 82, *Barnsbury Road, Islington, N.*
1217 1896. Jan. ‡Gray, John Henry, *Woodville, Melton Road, Leicester.*
1296 1896. Mar. ‡Griffin, John Taylor, 13, *The Parade, Chingford, Essex.*
1218 1896. Jan. ‡Hanks, Louis, 39, *Berners Street, W.*
1238 1896. Jan. ‡Harris, William Richard, 14, *Wyndham Road, Upton Park, E.*
1241 1896. Feb. ‡Hawes, George Albert, *Chapel Field, Norwich.*
1219 1896. Jan. ‡Hayward, Thomas William Alfred, *Linton Villa, Weston-super-Mare.*
1239 1896. Jan. ‡Heryet, Frank Arthur, 97, *Blackheath Hill, Greenwich, S.E.*
1297 1896. Mar. ‡Holden, Timothy, 1, *Pott Street, New Moston, Manchester.*
1250 1896. Jan. ‡Homersham, Miss Eliza Margery, 72, *Mercers Road, Tufnell Park, N.*
1251 1896. Jan: ‡Hubble, Arthur Thomas, *Church Street, Bloxwich, Walsall.*
1252 1896. Jan. ‡Johns, Miss Amy M., *The Towers, Winton, Bournemouth.*
1298 1896. Mar. ‡Kent, Walter, *High Street, Watton S.O., Norfolk.*
1240 1896. Jan. ‡Lane, Alexander Reuben, 3, *Barton Street, Baron's Court, Kensington, W.*
1253 1896. Jan. ‡Langstone, Charles, 21, *Page Street, Westminster.*
1299 1896. Mar. ‡Layland, William Thomas, *Packington Road, Ashby-de-la-Zouch, Leicestershire.*
1300 1896. Mar. ‡Lewis, John, 23, *Tower Road, Boscombe, Bournemouth.*
1263 1896. Jan. ‡Long, Frederick Thomas, 4, *Adelaide Place, London Bridge, E.C.*
1254 1896. Jan. ‡Mant, William, *High Street, Emsworth, Hants.*
1301 1896. Mar. ‡Mardell, Henry, 3, *Trinity Street, Harrow Green, Leytonstone, Essex.*
1282 1896. Feb. ‡Marsden, William Edward, 15, *Springfield Street, Darwen, Lancashire.*
1211 1896. Jan. ‡Martin, Ernest William Francis, 38, *Standen Street, Tunbridge Wells.*
1243 1896. Feb. ‡May, John Farrance, "*Borzelle,*" *Dunstan Road, Tunbridge Wells.*
1255 1896. Jan. ‡Millward, Richard John, *Holly Bush Vale, Hampstead, N.W.*
1265 1896. Jan. ‡Morley, George Gladstone, 126, *Marmont Road, Peckham, S.E.*
1212 1896. Jan. ‡Norris, Joseph Foxley, 13, *Alkham Road, Stoke Newington, N.*

1284 1896. Feb. ‡NUNNS, William Rhodes, 53, *North Street*, *Bingley*, *Yorkshire*.

1272 1896. Feb. ‡PENN, Ernest William, 54, *Brunner Road*, *Walthamstow*, *Essex*.

1285 1896. Feb. ‡PLEDGE, Miss Josephine Lucy de, *Chelsea Infirmary*, *Cale Street*, *S.W.*

1256 1896. Jan. ‡RACKHAM, George, 59, *Sumatra Road*, *West Hampstead*, *N.W.*

1267 1896. Jan. ‡SALKIELD, Tom, *Hythe Cottage*, *Vicarage Road*, *Teddington*.

1257 1896. Jan. ‡SEIG, John, 57, *Portnall Road*, *Paddington*, *W.*

1302 1896. Mar. ‡SILLITOE, Joseph William, 32, *Coleridge Street*, *Broughton*, *Manchester*.

1243 1896. Jan. ‡SIMS, Alfred, 1, *Lorne Villa*, *Victoria Road*, *Romford*, *Essex*.

1273 1896. Feb. ‡SINCLAIR, Frederick W., 16, *Rush Hill Road*, *Lavender Hill*, *S.W.*

1303 1896. Mar. ‡SMITH, Arthur, 14, *Church Road*, *Lowestoft*.

1266 1896. Jan. ‡STEPHENS, Alfred C., 26, *Longford Street*, *N.W.*

1258 1896. Jan. ‡SWINSON, Thomas, 75, *Westville Road*, *Shepherd's Bush*, *W.*

1274 1896. Feb. ‡SYKES, Francis, 74, *Mill Lane*, *Walsall*, *Staffs*.

1287 1896. Feb. ‡TEDHAM, William, 8, *St. John's Road*, *South Norwood*.

1304 1896. Mar. ‡VOS, Harold, *Harboro' Grove*, *Sale*, *Cheshire*.

1259 1896. Jan. ‡WARREN, Archibald Ralph, 73, *Breakspears Road*, *St. John's*, *S.E.*

1260 1896. Jan. ‡WEBB, Miss Ada F., 4, *Park Village East*, *N.W.*

1244 1896. Jan. ‡WEBSTER, John William, 4, *Devereux Terrace*, *Spital Road*, *Windsor*.

1305 1896. Mar. ‡WESTMORLAND, Charles J., *New Ferry Lane*, *New Ferry*, *Birkenhead*, *Cheshire*.

1306 1896. Mar. ‡WHITE, Robert, *Parochial Offices*, *Woodstock Road*, *Lee*, *S.E.*

1275 1896. Feb. ‡WHITEWOOD, Henry Thomas, 1, *St. John's Wood Road*, *Ryde*, *Isle of Wight*.

1307 1896. Mar. WICKS, John Thomas, *Bescott*, *Walsall*, *Stafford*.

1261 1896. Jan. ‡WYNNE, William, *Cardigan Villa*, *Bessborough Road*, *Harrow-on-the-Hill*.

1286 1896. Feb. ‡YARNALL, George Edward, *Loddon*, *Norwich*.

OBITUARY.

THOMAS WILLIAM THOMPSON, M.R.C.S., L.R.C.P., D.P.H.,

Medical Inspector to the Local Government Board.

(MEMBER.)

In the death of Mr. T. W. Thompson, at the early age of 44, the science of Epidemiology has lost one of its foremost representatives; indeed, few men's minds were better fitted than Mr. Thompson's to approach in a proper scientific spirit the etiological problems with which, by virtue of his official position, he was brought in contact. Before Mr. Thompson devoted his life to Sanitary science he had had an extensive and somewhat varied experience, an experience which served him in especially good stead in the more matter-of-fact administrative part of his official duties; while his love for the study of philosophy, to which he had devoted his spare moments from an early age, doubtless did much to engender in him that remarkable lucidity of expression and power of developing an argument, which was so characteristic of his reports and writings. After receiving his professional education at University College Hospital, and holding sundry resident appointments at other hospitals, Mr. Thompson studied at Netley, and eventually served with the Royal Horse Artillery in the Madras Presidency. A serious illness, however, cut short his stay in India, and on his restoration to health he was appointed to the high position of Surgeon to the First Life Guards. This post Mr. Thompson held for some five years, at the end of which time he married, and entered private practice at Potter's Bar. In practice he was eminently successful; indeed, he became universally beloved and respected in the neighbourhood, a fact which is borne evidence to by the handsome testimonials presented to him on his relinquishing private practice, and by the many and beautiful tokens of deep affection which were manifest when his numerous friends and colleagues bade their last tribute to his memory in the little country churchyard in Hertfordshire. While in practice Mr. Thompson contributed a valuable paper to the "Lancet," which showed that he possessed in a high degree scientific methods of thought, and that he had besides considerable literary ability; and during the same time he wrote an anonymous essay entitled "The New Conservatism," in which he discussed, in an exceptionally able manner, the philosophical aspect of certain political attitudes, adopting a somewhat similar line of argument to that which is taken by Mr. Herbert Spencer, in his admirable work on "The Man *versus* the State." It is necessary to mention this essay in anything approaching a thoughtful sketch of Mr. Thompson, but it must in justice be stated that he was free from anything approaching political partizanship, and that he would have recognised how fatal is the political bias to the carrying out of any system of sociology. Although, as has been said, Mr. Thompson was in every way successful in practice, his nature seems to have prompted him to seek a sphere of activity in which he would have occupation of a somewhat more scientific character than was possible in a busy practice; and, taking the Diploma of Public Health, he obtained the appointment of Medical Officer of Health for the combined Sanitary districts of Hertfordshire and Middlesex.

In the Public Health Service Mr. Thompson in all probability found himself in an environment congenial to his tastes and stimulating to his talents, and it was not long before it became evident to the Medical Department of the Local Government Board that he was a worker and thinker of no ordinary type; and an experience of his services as a temporary Inspector soon led to his being appointed permanently to the staff of the Medical Department. It would ill become the present writer to speak in detail of Mr. Thompson's services under the Local Government Board, but it may be observed that the late and present Chiefs of the Medical Department entertained the highest respect for his great abilities, and entrusted him with enquiries of a highly responsible nature. Mr. Thompson's death is a heavy loss to the Medical Department, and the memory of his manly presence and honest attractive nature will remain with his colleagues long after his name has been removed from the official lists. At the beginning of the present decade Mr. Thompson was asked by the editors of Stevenson and Murphy's "Treatise on Hygiene and Public Health" to contribute the Section on "The Natural History of Infectious Diseases," a task which he performed to the greatest satisfaction of every one, save perhaps himself; indeed, in the introductory chapter to that monograph Mr. Thompson applied the thesis of organic evolution to the varying manifestations of infectious disease in a most masterly fashion, and it was truthfully said of this Section by the "Lancet" review, that Mr. Thompson succeeded better than any other writer in the English language in conveying a faithful picture of what is known of the epidemiology of each of the principal infectious diseases. To have performed a work of this order of merit is something to have lived for, and on this score alone Sanitary science owes a debt of gratitude to Mr. Thompson's memory. The subject of "return" cases of scarlet fever was always a matter of much interest to Mr. Thompson, and in the autumn of last year he read before the Epidemiological Society of London a valuable and suggestive paper upon this subject, which was published in full in the "Lancet" of November 25th, 1895. Mr. Thompson died while actively engaged on an important Sanitary survey in the counties of Glamorganshire and Monmouthshire, and the manner of his death was in a sense characteristic of his life's work. He was taken suddenly ill while travelling to the scene of his day's work, but he insisted on proceeding with his inspectorial duties until he was absolutely unable to return even to the neighbouring town at which he was staying with his wife, who it may be added was his constant companion in his travels, and in a large sense his co-worker. In the course of thirty-six hours Mr. Thompson passed away in the little village inn to which he was taken; but his notes were found in so complete a state that the Local Government Board will, it is hoped, be able to publish the report upon which he was engaged. Of Mr. Thompson's lovable and attractive personality it will be out of place to speak here. Those who had the high privilege of intellectual communion with him cannot forget him, and those who had not that privilege must judge him, as he fain would have been judged, by his works.

H. TIMBRELL BULSTRODE.

MR. W. P. BUCHAN

(ASSOCIATE).

W. P. Buchan was born at Fraserburgh (Aberdeenshire), on 7th Dec., 1836. It was intended that he should study for a clerical or medical career, but his bent was found to be towards mechanics in some form or other. At the age of sixteen he was apprenticed to Messrs. White and Henderson who carried on business in Sauchiehall Street, Glasgow. This firm was one of the leading plumbers of the city and had acquired considerable reputation by the introduction of hot water into tenement dwelling houses, which at the time was considered to be a wonderful advance in houses of this kind.

Mr. Buchan having finished his apprenticeship and improved his knowledge of kindred subjects by attending the evening classes, started business on his own account in 1860. He continued to devote his attention to ventilation in addition to drainage, and in particular he recognised the immense value of a good trap for house drains. He patented what is known as "Buchan's trap," and by lectures and writing upon the subject soon convinced architects and their clients of its value. He patented what is known as the "cascade action" in this trap.

It was in 1871, however, that Mr. Buchan came to the front as a sanitarian. At the request of the proprietors of the "Building News"—when public attention was drawn to the subject by the illness of His Royal Highness the Prince of Wales—he contributed a series of articles on plumbing, these with some additions on house drainage were afterwards published as No. 191. in Weale's series, and was probably the first plumbers' handbook ever published in this country. This book has been of great value to the young plumber and indeed to all interested in sanitary matters; it has reached its sixth edition and he revised a seventh edition shortly before his death.

After completing his trap and getting it into general use he made improvements from time to time in almost every department of his work. Several of his inventions have received awards from The Sanitary Institute and are well known in practice.

In 1891 he again appeared as an author with his book on Ventilation.

Possibly the meetings which had the greatest interest for him were those of the Philosophical Society of Glasgow, of which he was made a life member in 1875. He was elected a Member of Council, was a Vice-President, and afterwards President of the Sanitary and Social Economy section. Out of this section sprang the Scottish Burial Reform and Cremation Society, and he attended and spoke at the first meeting; was always a Director, and his remains were cremated at the new Crematorium in Maryhill, on the 22nd February last. He was an ardent Cremationist, and it is remarkable that he was the first cremated after the formal opening of the buildings.

The other societies in which he took a warm interest were the Royal Scottish Society of Arts, Edin., of which he was made a Fellow, Feb., 1879; the Society for the Encouragement of Arts, Manufacture and Commerce which he joined in Feb., 1881; the British Association; Associate of The Sanitary Institute; Member of the Sanitary Association of Scotland; Member of the Institute of Engineers and Shipbuilders; and Life Fellow of the Scottish Society of Literature and Art, Glasgow.

He died on Thursday, 19th Feb., aged 59 years, and in him science has lost a reverend student and sanitary science an able exponent.

JAMES CHALMERS.

EXHIBITS ADDED TO THE MUSEUM.

JANUARY—MARCH, 1896.

DIVISION A.

SCIENCE IN RELATION TO HYGIENE.

Lantern Slides, illustrating various kinds of Closets, Drain Pipes, Stoppers, and Bends, &c. *Purchased.*

DIVISION B.

HYGIENE OF SPECIAL CLASSES, TRADES, AND PROFESSIONS.

Canal Boat (Model). Made to scale and representing a long Boat, as used for carrying Corn and Dry Goods on most English canals. The top of Cabin is made to lift off, to show the sleeping and living accommodation. *Jacob Rice.*

Stair Treads, Interchangeable. Specimens mounted in Brass, and in Galvanized Iron. *W. Gooding, Inventor.*

DIVISION C.

CONSTRUCTION AND SANITARY APPARATUS.

End Section of Bath, with Hot and Cold Water Valves, accessible waste and overflow. Material—Enamelled Iron.
Shanks & Co., Manufacturers.

Sewage Filter. A Photograph of a Working Model, shewing in section the arrangement of the method adopted for Sewage Filtration.
The Sewage and Effluent Water Filter Co., Manufacturers.

Old Wooden Water Pipe. A Specimen supposed to be part of the Water Conduit supplying the Old Manor House, Chelsea.
Louis C. Parkes, M.D., D.P.H.

Silicate Cotton or Slag Wool. Specimens made up into forms for Fire-proofing and Sound-proofing Buildings, Lining Roofs as a protection from heat or cold, and Covering Cistern Pipes.
Fredk. Jones & Co., Manufacturers.

Provision has been made for keeping, under a classified arrangement, Price Lists and Descriptions of Sanitary Appliances, so that information may be available with regard to Appliances not included in the Museum.

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⁂ *For publications of Societies and Institutions, &c., see under "Academies."*

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NOTES ON LEGISLATION AND LAW CASES.

Prepared by Prof. A. Wynter Blyth, Barrister-at-Law.

QUEEN'S BENCH DIVISION.

Before the Lord Chief Justice and a Special Jury.

TOUZEAU *v.* SLOUGH URBAN DISTRICT COUNCIL.

This was an action brought to recover damages for injuries caused to the Plaintiff and his family by a nuisance arising from an insufficient sewer of which the Defendants had control.

Mr. Witt, Q.C., in opening the case, said that the Plaintiff in May, 1893, became tenant of Spring Cottage, Upton Park, between Slough and Eton, for three years at £40 per annum. The outfall sewer from Slough passed close to his house, and soon after the Plaintiff arrived, a manhole which had been made near the front of Spring Cottage was moved to a distance of 120ft. from the house. In the winter of 1893 there were bad smells, and in June, 1894, the gravel walk round the new manhole was covered with an overflow of sewage. Complaint was made to the sanitary inspector, and the Council sent a quantity of gravel, which was spread over the sewage. In September it was found that the well belonging to the house was contaminated, and the servants suffered from sore throats in consequence of the smells. After the water had been analysed none was used without being boiled, and after December, in consequence of the doctor's advice the well water was not used at all. On

December 15, though there were no floods at that time, there was a great overflow of sewage from the manhole, forming a pool in the neighbouring field 40 yards by 50 yards in size and a foot deep. Soon afterwards the Plaintiff's youngest boy fell ill. On February 2, the Plaintiff and his family were compelled to leave the house, and they moved into Slough. Plaintiff had to be in school three times a week at 7 a.m., and the extra mile at that hour was a severe trial in February, 1895. His eldest boy fell ill of what proved to be typhoid fever, and though he did get better he had never recovered from the effects. The cause of the overflow was as follows. On leaving Slough the sewer decended a hill having a sharp gradient, and at the foot of the hill the ground became level and the fall of the sewer very slight until it reached the pumping station of the sewage works some distance beyond plaintiff's house. The flow of sewage was thus checked, and the resulting pressure drove the sewage up through the manhole. In order to relieve this pressure a valve was placed in the side of the sewer, between the foot of the hill and Upton Park, but this valve discharged the contents of the sewer into an open ditch, and, in consequence of complaints made by the owner of the land, the valve appeared to have been closed in December, 1894. Evidence was given in support of the above facts, Dr. Adams, the family doctor, saying that he had no doubt that the illness of the children and the servants was owing to the overflow of sewage.

Mr. Bucknill, on behalf of the Defendents, said that there was not sufficient evidence that the illness was caused by the overflow. It was too far from the house to have contaminated the well and the smell could not by itself have caused typhoid. In 1880 the Urban Sanitary Authority put down a sewer which was at the time sufficient, and when in 1893 they found that the old sewer was insufficient they at once took steps to borrow the money necessary for making a new one. There were the inevitable delays, but the new sewer was now finished. Finally, he suggested that the Plaintiff had never examined his own drains, which were probably the real cause of the pollution of the well.

Mr. Baker, the surveyor of the Urban District Council, gave evidence as to the position of the sewer. It was constructed in 1880 and was sufficient as long as there was no rain.

By His Lordship: If he had made it, it would have been larger. He came to the conclusion that the old sewer was insufficient soon after his appointment in 1882 and told the drainage committee.

Mr. Bucknill said that after this evidence, which came as a suprise to him, he could no longer contend that the sewer was originally sufficient.

Prof. Corfield said that typhoid was far more likely to result from drinking impure water than from bad smells. The sanitary arrangements at Spring Cottage were of an obsolete kind and would not now be allowed in any London house.

The Lord Chief Justice, addressing the jury, said that the case had become a question of damages after the evidence given by the surveyor Baker. What were the consequences of the insufficient sewer? They could hardly doubt that overflows such as had been described rendered the Plaintiff's house a most uncomfortable and unhealthy place of residence, and it was reasonable that he should leave it. He was entitled to damages for the move and to rent for the five quarters for which he was liable to his landlord and during which he had lost the use of the house. They would also consider the physical discomfort caused to him during the whole of his tenancy. There remained the question whether the illness was also caused by the overflows. In no view could they give anything for the illness of his family except in so far as it caused the Plaintiff actual expense. His Lordship then dealt with the evidence, including the items of special damage, which amounted to £165, including the £50 rent.

The jury, after ten minutes' absence, returned with a verdict for the Plaintiff, damages £250. Judgment accordingly.

COUNTY COURT DECISION WITH REGARD TO COMBINED DRAINAGE.

MAYOR AND CORPORATION OF EASTBOURNE *v.* OWEN BRADFORD.

(*Eastbourne Chronicle*, Feb. 22nd, 1896.)

The Borough of Eastbourne has adopted the Public Health Acts Amendment Act of 1890.

The 19th Section of that Act essentially alters the definition of "sewer" and "drain" as follows:—

"Where two or more houses belonging to *different owners* are connected with a public sewer by a single private drain, an application may be made under Section 41 of the Public Health Act, 1875 (relating to complaints as to nuisances from drains), and the Local Authority may recover any expenses incurred by them in executing any works under the powers conferred on them by that Section from the owners of the houses in such shares and proportions as shall be settled by their Surveyor or (in case of dispute) by a Court of Summary Jurisdiction. Such expenses may be recovered summarily, or may be declared by the Urban Authority to be private improvement expenses under the Public Health Acts, and may be recovered accordingly. For the purposes of this Section, the *expression 'drain' includes a drain used for the drainage of more than one building.*"

The action was brought by the Mayor and Corporation of Eastbourne against Mr. Owen Bradford for the recovery of £2 7s. 2d., being the latter's alledged proportion of expenses incurred by the Plaintiffs in re-laying a single private drain, &c., and interest thereon.

HIS HONOUR JUDGE MARTINEAU gave his decision as follows:—

The drain in question was one which connected a house belonging to the Defendant and other houses belonging to different owners with the public sewer. The parties had agreed to the facts and the question which he had to decide was whether the drain was a public sewer within the meaning of the Public Health Act, 1875, and of the Amendment Act of 1890, or whether it was a single private drain within the meaning of Section 19 of the last-mentioned Act. If he came to the conclusion it was a public sewer judgment would be for

Defendant, but if he held that it was a single private drain within Section 19 of the Act of 1890 then judgment would be for the Plaintiffs. The case was very neatly and concisely argued before him by Counsel representing the parties interested. Counsel for the Plaintiffs relied on a decision of the Divisional Court, in the case of Selfe *v.* the Hove Commissioners, as being an express authority in favour of the Plaintiff's case, while Counsel for the Defendant relied on the decision in Hill *v.* Hare as an authority in Defendant's favour. He was told that whichever way he decided there would be an appeal, provided leave was given, and he intimated at the hearing that the matter being one of general importance he should undoubtedly give leave. He did not propose to discuss the question he had to decide at any length, for he was satisfied the decision of the Divisional Court, in Selfe *v.* Hove Commissioners, was a clear authority in favour of the Plaintiffs and, unless he should come to the conclusion that the decision Hill *v.* Hare was an express authority in favour of the Defendant, his decision must be for the Plaintiffs. He had some hesitation in making any remarks or comments on the decision in Selfe *v.* Hove Commissioners, as it was an appeal from a decision of his own. His judgment was reversed on both points on which he decided. He might, however, just refer to the facts of that case. There were two semi-detached houses at Hove with a drain that was common to both houses. This drain was connected with the public sewer. The two houses were separate buildings and belonged to different owners, and the Sanitary Authority at Hove called on the Plaintiff, who was the owner of one of the houses, to relay the drain or to do what was necessary to abate a nuisance arising from the state of the drain, and threatened proceedings if the Plaintiff did not comply with the demand. The Plaintiff executed the necessary repairs and then called on the Sanitary Authority to pay the amount which he had expended on putting the drain in order, on the ground that the liability for the cost of such works was, by the Public Health Act, 1875, put upon the Authority and not the owner. The Authority repudiating the claim, the Plaintiff brought an action in the Court at Brighton to recover the amount. He had two questions to decide—(1), whether the duty of doing the work was, under the Act, laid on the Sanitary Authority, and (2), assuming the duty was on the Authority, whether the Plaintiff was to do it as a volunteer, or whether he, being required to do it, could recover the amount expended on the work. The second question arose on the assumption that it was the duty of the Sanitary Authority to execute the work. In the course of the argument he (the Judge) was referred to in a general way to the Public Health Amendment Act, 1890, but no argument was addressed to him showing that it was the duty of the owner, under Section 19 of that Act, to execute the work. He reserved judgment, and he found on his notes that he had been referred to the Act of 1890. On looking at that Act he could not see that it bore materially upon the matter, no argument having been addressed to him on the point. He decided the first question in favour of the Plaintiff. He held that the drain in question was a public sewer. He founded his decision on the judgment of Mr. Justice Wills in Travis *v.* Uttley, every word of which judgment appeared to him to apply to the case before him. So far as he could recollect he expressed no opinion as to the construction of the Public Health Act, 1875. He simply followed the judgment of Mr. Justice Wills. Having decided that the duty was on the Sanitary Authority to repair the drain, he decided the second point, whether the Plaintiff could recover the amount he had expended from the Authority. The Divisional Court held there was a fallacy in his opinion on this second point, and as nothing turned on this point in the present case, he would not refer further to it. The Divisional Court having decided that he was wrong on the second point, that disposed of the principal question of whether it was the duty of the Sanitary Authority or the Plaintiff to execute the repairs. As he understood the decision, it was that under Section 19 of the Amendment Act, 1890, it was the duty of the owner, not of the Sanitary Authority, to execute the works. As he had stated, this point was not argued before him, beyond a general reference to the Act of 1890. He confessed to doubts whether the decisions in Travis *v.* Uttley and Selfe *v.* Hove Commissioners could be reconciled, but the matter as regards the present case stood thus: He had an express decision before him that, according to the true construction of the Public Health Act, 1875, and the Amendment Act, 1890, each of the different owners in the case of a drain like this was required to execute the work necessary to abate a nuisance. That decision might be inconsistent with the decision in Travis *v.* Uttley and in Hill *v.* Hare, but he felt bound by the authority of Selfe *v.* Hove Commissioners, and therefore, without expressing any opinion of his own one way or the other, he must give judgment for the Plaintiffs for the amount claimed with costs. He certified for costs on the higher scale on the ground that a difficult point of law was involved, and that the matter was one of general public interest. Judgment in the other case, the Corporation *v.* George Gosden, would follow the result in this, and he would give leave to appeal.

GENERAL NOTES.

MENTAL AND PHYSICAL CONDITION OF CHILDREN.—The Committee appointed by the International Congress of Hygiene in 1891 (of which Sir Douglas Galton is Chairman) have just issued their report. They state that their object in undertaking this investigation of the mental and physical condition of childhood, was to furnish a reliable statement of existing conditions found among the pupils attending public elementary and other schools, and thus to establish a scientific basis for the study of the requirements of child-life, providing also information for the guidance of the State Educational authorities and Philanthropic bodies. The Report records the mental and physical defects noted among 100,000 children seen in various schools; these records are arranged in thirty classified Tables, and the co-relation and significance of the various defects discussed. The Report also contains recommendations and suggestions as to the conduct and administration of the education of feeble-minded children.

THE ATMOSPHERE OF COTTON SHEDS.—A representative meeting was recently held of employers and operatives interested in the Cotton Cloth Factories Act, under the auspices of the United Textile Workers' Association, to discuss whether the act required altering or not, the chief point dealt with being the effect on health of artificial humidity in cotton sheds. Mr. Geo. Whiteley, M.P., in the chair. Amongst those present were the following Members of Parliament:—Sir U. Kay-Shuttleworth, Sir J. Pease, Colonel Mellor, Mr. G. Kemp, Mr. P. Stanhope, Mr. F. Cawley, Mr. Platt-Higgins, Mr. Kenyon, Mr. Rutherford, Mr. C. P. Scott, Mr. W. H. Hornby, Mr. R. Ascroft, Mr. H. Whiteley, Mr. Schwann, Mr. Fielden, and Mr. J. H. Maden. Mr. Holmes stated the case for the Operative Spinners, contending that the Act was not being carried out in the spirit in which it was passed, and that steaming generally was injurious to health. Mr. Garnett said that the employers were prepared to show that the Act was beneficial to health, that since its enactment the health of the operatives had improved, and that the general ventilation of weaving sheds was much superior to that ever before experienced by operative weavers. Mr. Tattersall stated that there had been a steady improvement in the health of weavers since the Act had come into force. All authorities agreed that a proper amount of humidity in the atmosphere was beneficial to health. A long discussion ensued, in which nearly all the members of Parliament participated, after which the following resolution was unanimously adopted on the motion of Mr. Holmes, seconded by Mr. Tattersall: "That this meeting, representing both employers and operatives engaged in the cotton industry, is strongly of opinion that it is desirable that there should be an inquiry made by a committee of experts, appointed by the Home Office, into the working of the Cotton Cloth Factory Act, 1889, and into the whole question of steaming and the introduction of artificial moisture into cotton weaving sheds."—*Times, 20th Feb.*, 1896.

SANITARY APPOINTMENTS BY DUTCH AUCTION.—The "British Medical Journal" calls attention to a matter of considerable importance in Public Health administration. It appears that a new Urban District Council has adopted a very undesirable course for filling up its appointments. Advertisements were issued, signed by the Chairman, asking for applications for the posts of Medical Officer of Health and Sanitary Inspector, with a statement of the salaries required by the respective applicants. This is practically filling these offices by tender, and although no pledge is given in such cases that the lowest tender will be accepted, everyone knows that under the pressure of the rates the demand for economy is almost irresistible. This method of filling appointments is illegal, as the Local Government Board has, by Order of March 23rd, 1891, declared that an appointment for either a Medical Officer of Health or an Inspector of Nuisances "shall not be made unless an advertisement specifying the district for which such appointment is to be made, *together with the amount of salary proposed to be assigned*, and the day fixed for such appointment, shall have appeared in some public newspaper or newspapers circulating in the district of the Sanitary Authority at least seven days before the day so fixed." The italics are not in the Order, but the unmistakable emphasis of the words needs reinforcement for two reasons: first, in order to warn Sanitary Authorities against an illegal and useless course of action; and, secondly, in order to point out to medical men that when they take part in a Dutch auction as regards the value of Sanitary services, they are conniving at an illegal act, to say nothing of the grave ethical offence they commit as members of an honourable calling. It is almost inconceivable that any man of good standing should demean himself and his profession by responding to an advertisement inviting tenders for the discharge of responsible medical duties.

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FACTORY AND WORKSHOP ACTS, AND THE POWERS AND DUTIES OF SANITARY AUTHORITIES WITH REGARD TO WORKSHOPS.

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The most striking thing that impresses one in attempting to disentangle from the Factory and Workshops Acts, 1878 to 1895, the powers and duties of sanitary authorities, is that legislation by reference, if a convenient method of making laws, is an extremely inconvenient and complex method for the administration of laws. It dawns upon one, why the codifier of laws is often regarded as a greater benefactor than the maker of laws?

Legislation in reference to workshops in its main points is practically the same whether its application be metropolitan or extra-metropolitan; but for convenience sake metropolitan legislation forms a suitable basis for consideration.

In order to avoid tediousness and prolixity, sections of Acts of Parliament will not be quoted *verbatim*, or *in extenso*, in this running commentary, but the principal sections of the various statutes applicable to the Metropolis have been set out in an Appendix A, and to this a table, showing the corresponding sections of extra-metropolitan application, has been added in an Appendix B, which may also serve as a reference table.

In the first place, it is necessary to state some preliminary details, and to briefly enter into some definitions.

The Factory and Workshop Acts are now administered partly by the Home Office, through H.M. Chief and District Inspectors of Factories, and partly by Sanitary Authorities, through Medical Officers of Health and Sanitary Inspectors. Factories fall entirely under the supervision of the former, and workshops, as to their sanitary condition, under the control of the latter. There are also a considerable number of sections in the Acts that are impersonal, and under which legal proceedings may be taken by persons aggrieved.

For the practical purposes of Sanitary Authorities, and without entering into definitions of textile and non-textile factories, it is sufficient to know that the use of steam, water, or any other form of mechanical power for manufacture in any workshop or workplace converts it into a factory under the supervision of the Home Office. As to workshops, which may be wholesale, retail, or sub-contracting, these are of three kinds:—

(1) Those in which protected persons are employed, *i.e.*, a child under fourteen years, a young person over fourteen and under eighteen years, and a woman over eighteen years of age.

(2) Those in which protected persons are not employed.

(3) Domestic workshops, *i.e.*, where members of one family are employed at home.

It is to be observed that any premises in which the dressing or finishing of lace, the printing of paper by hand blocks, letterpress printing, and bookbinding are carried on, are included in the list of non-textile factories, Part I., 4th Sch. of the Act of 1878, and that non-ornamental brick and tile works are excluded from earthernware and china works, and the cutting of wood from lucifer match works. There are many bewildering minor modifications of a similar kind in the Acts; but it is inadvisable to spend time upon them at the expense of more important principles.

In the next place, let us briefly consider how a sanitary authority is to become cognizant of the workshops within its district.

The occupier of every factory and workshop, whether protected persons are employed or not, is required to give notice within one month of the commencement of occupation to the Factory Inspector of the district; and the occupier of every workshop already in occupation is required to give similar notice within the year 1896. These notices as to workshops are to be forthwith forwarded by the Inspector of Factories to the Sanitary authority of the district. The lists of outworkers and sub-contractors kept at factories and workshops also afford further information. In addition to these, the complaints received, and a systematic inspection of the district, will bring to light many workplaces. By means of these forms of information, registers may be compiled for permanent reference. It is to be presumed that some widely-circulated public announcement will issue from the Home Office, calling the attention of occupiers of workshops to the requirement to give notice before the termination of the year, and that sanitary authorities will, in due course, receive all the notices relating to workshops.

. When we reach nuisances we have an apt illustration of the involved nature of the legislation we are dealing with.

The Factory and Workshop Act of 1878, section 3, relating to effluvia, overcrowding, ventilation, etc., and section 33, relating to lime-washing, washing, etc., applied to all factories and workshops.

The same Act, section 61 (1), exempted domestic workshops from sections 3 and 33.

The same Act, section 101, exempted from the nuisances section (91) of the Public Health Act of 1875, all factories and workshops within the provisions of the Factory and Workshop Act, but relegated to the nuisances section above mentioned, every other factory, workshop, or workplace.

The Factory and Workshop Act of 1891, by section 39 and schedule 2, withdrew workshops within the Factory and Workshop Acts from section 101 of the Factory and Workshop Act, 1878.

The same Act of 1891, by section 3 (1) withdrew workshops from sections 3 and 33 of the Factory and Workshop Act, 1878.

The net result of these cross references is that all extra-metropolitan workshops and work places are relegated by the Factory and Workshop Act, 1891, to section 91 of the Public Health Act of 1875, and similarily section 2 of the Public Health London Act, 1891, has now within its pale all metropolitan workshops and workplaces.

It is not necessary to set out the general nuisances of Section 2 of the last-named Act, which apply to any premises or places. But, confining our attention to those nuisances special to workplaces, it is the duty of a Sanitary Authority to see, with regard to every workshop within its district,

1. That it is kept in a cleanly state.
2. That it is kept free from effluvia arising from any drain, closet, urinal, &c.
3. That it is ventilated in such a manner as to render harmless any gases, vapours, dust, or other impurities generated in the course of the work carried on therein.

4. That it is free from overcrowding—that is, that at least two hundred and fifty cubic feet of space per head are provided during ordinary working hours, and four hundred cubic feet during overtime.

5. That the prescribed notice specifying the number of persons who may be employed in each room is duly affixed at the entrance to the workshop, or that the fact is otherwise made known.

6. That a reasonable temperature is maintained in each workroom.

7. That it is limewashed, cleansed, or purified, when necessary for health as certified by an officer of the Sanitary Authority—bakehouses being excepted and otherwise provided for.

8. That it is provided with sufficient and suitable sanitary conveniences for each sex.

9. That note is made of the employment of protected persons, in order that the Factory Inspector may be informed.

10. That the list of outworkers is inspected.

One or two of these points require a little further explanation. It is scarcely necessary to say that full powers of entry are provided for the officers of Sanitary Authorities, in order to execute their duties under the Public Health Acts and under these Acts. It will be noted that by Section 33 of the Act of 1895 power is given to require mechanical means of ventilation to be employed where necessary, and in such dusty occupations as dirty paper, and rag-sorting in closely confined quarters, this may be requisite in some cases; also where large quantities of gas are burnt during ordinary work or in overtime, although the extra provision of space—150 cubic feet per head during overtime work—is probably intended to meet this. But, the exercise of this power, even in the case of workshops, is given to the Factory Inspector by Sec. 36 of the Act of 1878, and not to the Sanitary Authority. As to what is a reasonable temperature, the requirements of the particular process of work must be taken into consideration. The optimum air temperature for man is generally considered to be 62° F., 5 degrees more or less is an allowable variation, but anything exceeding 10 degrees above or below the standard of 62° F. may well be considered unreasonable; to sit long hours in a workroom at or below 52° F. cannot be beneficial either to the work or the worker. Sufficient sanitary conveniences is usually held to be satisfied by the provision of one W.C. for every twenty persons of each sex. It is the duty of Sanitary Authorities also to see that this provision is made in factories as well as in workshops, although it does not appear that any special power of entry into factories is given for this purpose.

In the case of any act, neglect, or default punishable or remediable under the law relating to public health in a factory or a workshop coming to the knowledge of a Factory Inspector, he is required to give notice thereof to the Sanitary Authority of the district in writing. Thereupon it is the duty of the Sanitary Authority to take action within one month, and to inform the Inspector of the proceedings taken. If no proceedings are taken the Factory Inspector is empowered to take proceedings, and to recover the cost from the Sanitary Authority. Furthermore, if the Secretary of State is satisfied that the provisions of the law relating to public health are not being observed in any workshops of a district, or in any particular class of workshops, he may, by order, direct a Factory Inspector to enforce the provisions, and take proceedings, and recover the cost from the Sanitary Authority.

In addition to the ordinary requirements for a workshop already enumerated, it is also the duty of a sanitary authority, with regard to every bakehouse within its district, to see:—

1. That the inside walls, ceilings, &c., are (*a*) either painted or varnished every seven years and washed every six months, or are (*b*) limewashed every six months.
2. That a sleeping place is effectually separated from any bakehouse in the same building, and is lighted and ventilated by an external window at least nine feet square, one half being made to open.
3. That a bakehouse cistern is separate and distinct from any water-closet cistern.
4. That any water-closet, earth-closet, privy, or ashpit is cut off from direct communication with a bakehouse.
5. That no drain or pipe for carrying off fœcal or sewage matter has an opening in the bakehouse.
6. That no bakehouse is in such a state as to be, on sanitary grounds, unfit for use as a bakehouse.
7. That no underground bakehouse is newly brought into use.

The last three points are open to considerable limits in definition. Openings for carrying off liquid refuse or waste waters which are not actually fœcal matters, always communicate directly with drains carrying such matters, and liquid refuse is certainly sewage matter. It requires to be more clearly stated whether any drain opening is at all allowable in a bakehouse. Bakers say it is necessary to have a sink at hand for refuse liquids, and in most town bakehouses—due to improper construction—there is no place for them except within the bakehouse. In the night, when baking goes on, who shall say that they are not used as urinals, and we have evidence that the bacilli of typhoid fever are largely voided in the urine, and ambulatory typhoid is not uncommon. The sanitary grounds on which a bakehouse may be considered unfit for use are often of a structural nature, difficult and often impossible to completely overcome in many existing bakehouses, due to their underground construction. Although palliative measures can only be applied to such bakehouses now in use, the Act of 1895 prevents disused underground bakehouses being brought into use again, and new ones being constructed. But the law does not define what is meant by an underground bakehouse, whether wholly or partially underground. The most important point seems to have been overlooked, as it has been overlooked in Building Acts and elsewhere. It is not a question so much whether the bakehouse is underground, but whether attached to the building there is or is not a sufficient amount of open space for light, air, ventilation, and drainage. A bakehouse entirely above ground, without such provision, is as bad as an underground bakehouse, or any other kind of workshop or dwelling under similar conditions.

In the Public Health (London) Act, 1891, section 141, the expression "bakehouse" means any place in which are baked bread, biscuits, or confectionery, from the baking and selling of which a profit is derived, that is to say, whether wholesale or retail. In the Factory and Workshop Act, 1883, section 17 (1), it is provided that the Sanitary Authority shall enforce the sanitary provisions with regard to "retail bakehouses," and they are defined as places where the bread, biscuits, or confectionery, in which are not sold wholesale, but by retail in some place occupied together with such bakehouse, which is not a factory within the meaning of the Act of 1878. Section 36 of the Act of 1891 merely repeats the exclusion of bakehouses which are factories from the expression "retail bakehouse." The interesting point is the curious fact that in the metropolis wholesale bakehouses (not factories) are controlled by Sanitary Authorities, whereas outside the metropolis, if they are controlled by Sanitary Authorities at all, they appear to become ordinary workshops not subject to the special requirements of bakehouses, another of the strange results of the complicated provisions of legislation by cross references.

The sanitary provisions, the affixing of notices and abstracts, notice of occupation, and other provisions of the Factory and Workshop Acts, now apply to laundries, except to laundries of certain public institutions, domestic laundries, and laundries where not more than two non-residents are employed, but they are not excluded from the Public Health Acts. Of a laundry there is no definition in the Acts, but in common acceptation it is a place where clothes are washed and dressed. Here, in addition to the necessary points applicable to all workshops, special attention requires to be directed to prevent nuisances from excessive heat in ironing rooms, and from accumulation and condensation of steam in washhouses, from noxious fumes of gas-irons, and of stoves for heating irons, and from bad flooring and draining of the surface. By Sec. 22 (2) of the Act of 1895, in laundries which are factories, a fan or other proper appliance is compulsory in every ironing room to regulate the temperature, and in every washhouse to carry away the steam, but these and other compulsory powers in this section are not given to Sanitary Authorities for the control of laundries which are workshops.

For the purposes of proper record, it is necessary for Sanitary Authorities to keep Registers (*a*) of workshops generally, (*b*) of bakehouses, and (*c*) of laundries. In keeping these Registers, in addition to the particular points already mentioned, record will have to be made of the situation of the premises, the kind of work carried on, the name and address of the occupier, the name of the owner, details of the whole premises, of the persons employed, and of each workroom. In order to complete these Registers, the systematic inspection of all workshops within a district is also necessary. For this purpose special Sanitary Inspectors have been appointed in Islington (2), Kensington (2), St. Pancras (2), Whitechapel (2), Birkenhead (1), Bradford (1), Brighton (1), Bristol (1), Hull (1), Leeds (1), Liverpool (2), Manchester (6), Nottingham (2), Portsmouth (2), and Salford (1).

Of these Inspectors some are women—in Islington (1), Kensington (1), St. Pancras (1), Manchester (6), Nottingham (1), Brighton (1).

The duties may be so divided between men and women Sanitary Inspectors, that workshops where men are mainly employed, and bakehouses, may fall to the men, and workshops where women and young persons are mainly employed, and laundries, may fall to the women. The abatement of smoke nuisances also pertains entirely to these officers, since Sanitary Authorities are empowered to suppress smoke nuisances and noxious effluvia arising from both factories and workshops.

Other Sanitary Inspectors would also refer to the Inspectors specially authorised to inspect all the workshops, bakehouses, and laundries they may become cognizant of in the course of their duties.

By section 27 of the Factory and Workshop Act of 1891, it was provided that the occupier of every factory and workshop and every contractor employed by such occupier shall, if required by order of the Secretary of State, keep a list of all persons employed, either as workmen or as contractor, outside the factory or workshop, and of the places where they are employed, such list to be open to inspection by any Factory Inspector or Officer of a Sanitary Authority. In November, 1892, the Secretary of State made such an order with regard to the manufacture of wearing apparel, electro-plate and files, cabinet and furniture making, and upholstery work. By section 42 of the Factory and Workshop Act of 1895, it was further provided that the lists described in section 27 of the Act of 1891 shall be sent, on the 1st of March and the 1st of September in each year, to the Factory Inspector of the District, and it was also provided that section 27 of the Act of 1891 shall (by statute) apply to any place from which any work of making wearing apparel for sale is given out, as if that place were a workshop. That is to say, it now applies also to shops where no work is actually done, but where work is given out to be done upon wearing apparel.

It will be observed that the lists relating purely to shops, workshops, and the out-workers and contractors employed in making wearing apparel are to be sent to the Factory Inspector of the District, and no provision is made for sending them to the Sanitary Authority. It will be difficult for a Factory Inspector to know from what places such lists should be sent, and, if sent, such lists will in the large majority of cases be of no use to him. The only use would probably be as to the employment of protected persons, and in such cases the Sanitary Authority is required to give him notice. On the whole the provision here made will be found to be unworkable in the manner provided, unless supplemented by the sending of copies of these lists to the respective Sanitary Authorities by Inspectors of Factories.

With reference to the relationship of the Sanitary Authority to the Inspector of Factories, by section 26 of the Factory and Workshop Act of 1891, notices of the opening of new workshops, and by section 41 of the Factory and Workshop Act of 1895, notices of the occupation of existing workshops must be sent to the Inspector of Factories, and by him forwarded forthwith to the Sanitary Authority of the district. On the other hand, by section 27 of the Public Health (London) Act, 1891, if the Medical Officer of Health becomes aware of any child, young person, or woman, being employed in a workshop, he must forthwith give notice of the fact to the Factory Inspector of the District. Presumably, also, although the Acts do not so specify, he will notify to the Factory

Inspector of the District those workshops (excepting domestic workshops) where the Abstract and Notices prescribed by the Secretary of State are not affixed, especially the notice specifying the number of persons who may be employed in each room of workshop premises.* Otherwise it will be difficult for the Sanitary Authority to control overcrowding, and in reference to this control, it is within the power of an Inspector of Factories, but not within the power of a Sanitary Authority's Officer, to direct that a notice shall be affixed in each workroom as to the number of persons that may occupy it, in addition to the notice required by Statute to be affixed at the entrance to the premises.

Section 29 of the Act of 1895 provides that any case of lead, phosphorus, or arsenical poisoning, and of anthrax, contracted in any factory or workshop, shall be notified by the medical attendant to the Chief Inspector of Factories; that written notice of the case shall then be sent to the Factory Inspector and to the Certifying Surgeon, and be regarded as an accident, of which the latter is required to investigate the nature and cause. Now that the recently-appointed Chief Inspector of Factories is a thoroughly experienced and well-known Medical Officer of Health, the objection raised to this provision has not the weight it originally undoubtedly had; but this entirely new departure in the notification of disease will be watched with interest both by the public and the medical profession. Washing conveniences are also now required to be provided where lead, arsenic, or other poisonous substances, are used in any factory or workshop. Further, the occupier of a factory or workshop is not allowed to employ any woman within four weeks after childbirth. And, to complete the matter, an occupier of a factory or workshop is liable to pay penal compensation to any person suffering injury to health directly attributable to his neglect to observe any provision of the Acts, or any special rule or requirement made under Section 8 of the Act of 1891.

A few words must be devoted to the section of last year's Act which provides that the occupier of any place where wearing apparel is made, cleaned, or repaired, or where it is given out for these purposes, or any sub-contractor of the occupier, is liable to a maximum penalty of ten pounds, if he allows any wearing apparel to be made, cleaned, or repaired in any dwelling house or building occupied therewith, whilst any inmate is, to his reasonable knowledge, suffering from scarlet fever or small pox. This will apply to tailoring, dressmaking, millinery, etc., as well as to laundrying, mangling, etc. It is rarely that an employer knows anything of the health of other persons residing in the same houses as his employees. He can only know of small-pox or scarlet fever if he be informed by his employee, or by the Sanitary Authority, whose Officer again would in turn have to be informed by the employee of the name and address of the employer, and there is no compulsion to disclose this, so that the working of this section must depend mainly upon the goodwill of the employee, to whom no provision of compensation for loss of employment is made. As Medical Officers of Health are notified of all cases of scarlet fever and small pox, what is really required is to give specific power to Sanitary Authorities to enforce removal to hospital of any case of scarlet fever or small pox occurring in any house where wearing apparel continues to be made, cleaned, or repaired.

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* I am informed that registers of workshops in which men only are employed are not kept by Inspectors of Factories, and the shops are not visited by them except upon the receipt of a complaint; and, also, that information from Sanitary Authorities as to the absence of Notices in these workshops is declined, the reason being that workshops where adult men only are employed are excluded from the principal Act (F. & W. A., 1878), by Section 96, last paragraph but one, but such workshops are not excluded from the Public Health Acts, and the occupiers are not exempted from giving notices of occupation, which notices have to be forwarded to Sanitary Authorities. (See Section 26, F. & W. A., 1891, and Section 41, F. & W. A., 1895.)

The last point of which mention must be made is that Sanitary Authorities (in London, the County Council) are required to furnish to factories employing more than forty persons certificates that they are provided with means of escape in case of fire, and to enforce such provision for means of escape.

There is a feeling amongst some occupiers of workshops that the diversity of inspections is distressing to their business. The Factory and Workshop Acts provide for the supervision of the conditions (*a*) of employment, (*b*) of safety, and (*c*) of sanitation. The Home Office Inspector attends to the affixing of notices, &c., the County Council Inspector (in London) carries out the Shop Hours Act, and the Sanitary Authority's Inspector deals with sanitation; in addition to these Officers District Visitors from Trades Unions and Philanthropic Socie- also pay their attentions to workshops.

In concluding, as in commencing, it is impossible to refrain from expressing the hope that the complications and cross references of factory and workshop legislation may, at no distant date, be reduced to a simpler and less complex form by re-codification. It is, at least, cheering to see that the promise of the future appears now to be in the direction of the more adequate recognition of sanitary knowledge in the supervision of factories and workshops.

APPENDIX A.

Leading Sections of the Factory and Workshop Acts, 1878–95, and of the Public Health (London) Act, 1891, applicable to Workshops in the Metropolis.

Factory and Workshop Act, 1878.

Sec. 93. The expression "textile factory" in this Act means:

Any premises wherein or within the close or curtilage of which steam, water, or other mechanical power is used to move or work any machinery employed in preparing, manufacturing, or finishing, or in any process incident to the manufacture of cotton, wool, hair, silk, flax, hemp, jute, tow, china-grass, cocoa-nut fibre, or other like material, either separately or mixed together, or mixed with any other material, or any fabric made thereof.

Provided that print works, bleaching and dyeing works, lace warehouses, paper mills, flax scutch mills, rope works, and hat works, shall not be deemed to be textile factories.

The expression "non textile factory" in this Act means:

(1) Any works, warehouses, furnaces, mills, foundries, or places named in Part One of the Fourth Schedule to this Act.

(2) Also any premises or places named in Part Two of the said Schedule wherein, or within the close or curtilage or precincts of which steam, water, or other mechanical power is used in aid of the manufacturing process carried on there.

(3) Also any premises wherein, or within the close or curtilage or precincts of which any manual labour is exercised by way of trade or for purposes of gain, in or incidental to the following purposes, or any of them; that is to say:

(*a*) In or incidental to the making of any article or part of any article; or (*b*) In or incidental to the altering, repairing, ornamenting, or finishing of any article; or (*c*) In or incidental to the adapting for sale of any article; and wherein, or within the close or curtilage or precints of which steam, or other mechanical power is used in aid of the manufacturing process carried on there.

The expression "factory" in this Act means textile and non-textile factory, or either of such descriptions of factories.

The expression "workshop" in this Act means:

(1) Any premises or places named in part two of the Fourth Schedule to this Act, which are not a factory within the meaning of this Act.

(2) Also any premises, room, or place, not being a factory within the meaning of this Act, in which premises, room, or

place, or within the close or curtilage or precincts of which premises any manual labour is exercised by way of trade or for purposes of gain, in or incidental to the following purposes or any of them; that is to say:

(*a*) In or incidental to the making of any article or of part of any article; or (*b*) In or incidental to the altering, repairing, ornamenting, or finishing of any article; or (*c*) In or incidental to the adapting for sale of any article; and to which or over which premises, room, or place, the employer of the persons working therein has the right of access or control.

A part of a factory or workshop may for the purposes of this Act be taken to be a separate factory and workshop.

(And a room solely used for the purpose of sleeping therein shall not be deemed to form part of the factory or workshop for the purposes of this Act, Factory and Workshop Act, 1891).

Where a place situate within the close, curtilage, or precincts forming a factory or workshop, is solely used for some purpose other than the manufacturing process or handicraft carried on in the factory or workshop, such place shall not be deemed to form part of the factory or workshop for the purposes of this Act, but shall, if otherwise it would be a factory or workshop, be deemed to be a separate factory or workshop, and be regulated accordingly.

Any premises or place shall not be excluded from the definition of a factory or workshop by reason only that such premises or place are or is in the open air.

The Act shall not apply to such workshops, other than bakehouses, as are conducted on the system of not employing any child, young person, or woman therein, but save as aforesaid applies to all factories and workshops as before defined, inclusive of factories and workshops belonging to the Crown; provided that in case of any public emergency a Secretary of State may exempt a factory or workshop belonging to the Crown from the Act to the extent and during the period named by him.

* * * *

FOURTH SCHEDULE. PART I.—NON-TEXTILE FACTORIES.

(1) Print works. (2) Bleaching and dyeing works. (3) Earthenware works. (4) Lucifer match works. (5) Percussion-cap works. (6) Cartridge works. (7) Paper-staining works. (8) Fustian cutting works. (9) Blast furnaces. (10) Copper mills. (11) Iron mills. (12) Foundries. (13) Metal and india-rubber works. (14) Paper mills. (15) Glass works. (16) Tobacco factories. (17) Letterpress printing works. (18) Bookbinding works. (19) Flax scutch mills.

PART II.—NON-TEXTILE FACTORIES AND WORKSHOPS.

(20) Hat works. (21) Rope works. (22) Bakehouses. (23) Lace warehouses. (24) Shipbuilding yards. (25) Quarries. (26) Pit banks.

Factory and Workshop Act, 1878.

Sec. 97. The exercise in a private house or private room by the family dwelling therein, or by any of them, of manual labour by way of trade or for purposes of gain, in or incidental to any of the handicrafts specified in the Fifth Schedule to this Act, shall not of itself constitute such house or room a workshop within the meaning of this Act. When it is proved to the satisfaction of a Secretary of State, that by reason of the light character of the handicraft carried on in any private room by the family dwelling therein, or by any of them, it is expedient to extend this section to that handicraft he may by order extend the same.

FIFTH SCHEDULE. SPECIAL EXEMPTIONS.

Straw plaiting. Pillow-lace making. Glove making.

Factory and Workshop Act, 1891.

Sec. 37. (2) In this Act the expression "domestic workshop" means a workshop to which Sec. 16 of the principal Act applies.

Factory and Workshop Act, 1878.

Sec. 16. Where persons are employed at home, that is to say, in a private house, room, or place, which, though used as a dwelling, is by reason of the work carried on there, a factory or workshop within the meaning of this Act, and in which neither steam, water, nor other mechanical power is used in aid of the manufacturing process carried on there, and in which the only persons employed are members of the same family dwelling there, the foregoing regulations of this Act with respect to the employment of children, young persons and women, shall not apply to such factory or workshop, and in lieu thereof the following regulations shall be observed therein.

Factory and Workshop Act, 1891.

Sec. 26. (1) Sec. 75 of the Principal Act (which requires notice to be given of the occupation of a factory) shall apply to a workshop (including any workshop conducted on the system of not employing any child, young person, or woman therein) in like manner as it applies to a factory.

(2) Where an Inspector receives notice in pursuance of this section with respect to a *workshop*, he shall forthwith forward the notice to the Sanitary Authority of the district in which the workshop is situate.

Factory and Workshop Act, 1895.

Sec. 41. Every person who is in occupation of a workshop at the commencement of this Act, shall before the expiration of twelve months from the commencement of this Act, unless he has already done so in pursuance of Sec. 26 of the Act of 1891, serve on the Inspector for the district a written notice, containing the name of the workshop, the place where it is situate, the address to which he desires his letters to be addressed, the nature of the work, and the name of the person or firm, under which the business of the workshop is carried on, and in default shall be liable to a fine not exceeding five pounds. Any notice so served shall be forthwith forwarded to the Sanitary Authority of the district, in which the workshop is situate.

Factory and Workshop Act, 1891.

Sec. 27. (1) The occupier of every factory and workshop (including any workshop conducted on the system of not employing any child, young person, or woman therein) and every contractor employed by any such occupier in the business of the factory shall, if so required by the Secretary of State by an Order made in accordance with Sec. 65 of the principal Act, and subject to any exceptions mentioned in the Order, keep in the prescribed form and with the prescribed particulars lists showing the names of all persons employed by him, either as workman or as contractor, in the business of the factory or workshop, outside the factory or workshop, and the places where they are employed, and every such list shall be open to inspection by any inspector under the principal Act, or by any officer of a Sanitary Authority.

(2) In the event of a contravention of this section by the occupier of a factory or workshop, or by a contractor, the occupier or contractor shall be liable to a fine not exceeding forty shillings.

(An Order and prescribed Form of the Secretary of State requiring occupiers of the following factories and workshops, and contractors of occupiers, to keep lists of outworkers, came into force on the 20th November, 1892, namely the manufacture of wearing apparel, the manufacture of electro plate, cabinet and furniture making and upholstery work, the manufacture of files.)

Public Health (London) Act, 1891.

Sec. 10. The Sanitary Authority shall have a right to enter from time to time any premises (*a*) for the purpose of examining as to the existence thereon of any nuisance liable to be dealt with summarily under this Act, at any hour by day, or in the case of a nuisance arising in respect of any business, then at any hour when the business if in progress or is usually carried on. . . . .

Sec. 2. (1) For the purpose of this Act,—. . . . (*g*) Any factory, workshop, or workplace, which is not a factory subject to the provisions of the Factory and Workshop Act, 1878, relating to cleanliness, ventilation, and overcrowding, and (*i.*) is not kept in a cleanly state and free from effluvia arising from any drain, privy, earth-closet, water-closet, urinal, or other nuisance, or (*ii.*) is not ventilated in such a manner as to render harmless as far as practicable any gases, vapours, dust, or other impurities generated in the course of the work carried on therein that are a nuisance or injurious or dangerous to health, or (*iii.*) is so overcrowded while work is carried on as to be injurious or dangerous to the health of those employed therein,—shall be nuisances liable to be dealt with summarily under this Act. (2) Provided that— . . . . (*ii.*) In considering whether any dwelling-house or part of a dwelling-house which is used also as a factory, workshop, or workplace, or whether any factory, workshop, or workplace used also as a dwelling-honse, is a nuisance by reason of overcrowding, the Court shall have regard to the circumstance of such other user.

Factory and Workshop Act, 1895.

Sec. 1. (1) A factory shall for the purpose of Section 3 of the principal Act, and a workshop shall, for the purpose of the law relating to public health, be deemed to be so overcrowded as to be dangerous or injurious to the health of the persons employed therein, if the number of cubic feet of space in any room therein bears to the number of persons employed at once in the room a proportion less than two hundred and fifty, or, during any period of overtime, four hundred cubic feet of space to every person.

(2) Provided that the Secretary of State may, by order made in accordance with Section 65 of the principal Act, modify this proportion for any period during which artificial light other than electric light is employed for illuminating purposes, and may, by like order, as regards any particular manufacturing process, or handicraft, substitute for the said figures of two hundred and fifty and four hundred respectively any higher

figures, and thereupon this section shall have effect as modified by the order.

(3) Sec. 78 of the principal Act shall be read as if there were included among the notices required by that section to be affixed a notice specifying the number of persons who may be employed in each room of the factory or workshop by virtue of this section.

Factory and Workshop Act, 1878.

Sec. 78. There shall be affixed at the entrance of a factory and a worskhop, and in such other parts thereof as an Inspector for the time being directs, and be constantly kept so affixed in the prescribed form, and in such position as to be easily read by the persons employed in the factory or workshop.

(1) The prescribed abstract of this Act; and

(2) A notice of the name and address of the prescribed Inspector, and

(3) A notice of the name and address of the certifying Surgeon for the district, and

(4) A notice of the clock (if any) by which the period of employment and times for meals in the factory or workshop are regulated; and

(5) Every notice and document required by this Act to be affixed in the factory or workshop.

In the event of a contravention of this section in a factory or workshop, the occupier of the factory or workshop shall be liable to a fine not exceeding forty shillings.

* * * *

Sec. 96. In this Act, unless the context otherwise required—

* * * *

The expression "prescribed" means prescribed for the time being by a Secretary of State.

Factory and Workshop Act, 1878.

Sec. 61. The provisions of this Act which relate:

(3) To the affixing of any notice or abstract in a factory or workshop; or specifying any matter in the notice so affixed; or shall not apply

(*a*) Where persons are employed at home, that is to say, to a private house, room or place which, though used as a dwelling, is by reason of the work carried on there a factory or workshop within the meaning of this Act, and in which neither steam, water, nor other mechanical power is used, and in which the only persons employed are members of the same family dwelling there.

Factory and Workshop Act, 1895.

Sec. 32. (1) In every factory and workshop adequate measures shall be taken for securing and maintaining a reasonable temperature, in each room in which any person is employed. (2) A factory or workshop in which there is a contravention of this section, shall be deemed not to be kept in conformity with the principal Act.

Public Health (London) Act, 1891.

Sec. 25. (1) Where, on the certificate of a Medical Officer of Health or Sanitary Inspector, it appears to any Sanitary Authority that the limewashing, cleansing, or purifying of any workshops (other than a bakehouse), or of any part thereof is necessary for the health of the persons employed therein, the Sanitary Authority shall serve notice in writing on the owner or occupier of the workshops to limewash, cleanse, or purify the workshops or part, as the case requires, within the time specified in the notice, and if the person on whom notice is so served fails to comply therewith, he shall be liable to a fine not exceeding five pounds, and to a further fine not exceeding ten shillings for every day during which he continues to make default after conviction; and the Sanitary Authority may, if they think fit, cause the workshops or part to be limewashed, cleansed, or purified, and may recover in a summary manner the expenses incurred by them in so doing from the person on whom the notice was served. (2) This section shall apply to any factory that is not subject to the provisions of the Factory and Workshops Act, 1878, and the Acts amending the same, and to any workplace, in like manner as it applies to a workshop.

Public Health (London) Act, 1891.

Sec. 38. (1) Every factory, workshop, and workplace, whether erected before or after the passing of this Act, shall be provided with sufficient and suitable accommodation in the way of sanitary conveniences, regard being had to the number of persons employed in or in attendance at such building, and also where persons of both sexes are, or are intended to be employed, or in attendance, with proper separate accommodation for persons of each sex. (2) Where it appears to a Sanitary Authority that this section is not complied with in the case of any factory, workshop, or workplace, the Sanitary Authority shall, by notice served on the owner or occupier of such factory, workshop, or workplace, require him to make the alterations and additions necessary to secure such compliance, and if the person served with such notice fails to comply therewith, he shall be liable to a fine not exceeding twenty pounds, and to a fine not exceeding forty shillings for every day after conviction during which the non-compliance continues.

Factory and Workshop Act, 1878.

4. Where it appears to an Inspector under this Act that any act, neglect, or default in relation to any drain, water-closet, earth-closet, privy, ashpit, water supply, nuisance, or other matter in a factory, or workshop, is punishable or remediable under the law relating to public health, but not under this Act, that Inspector shall give notice in writing of such act, neglect, or default to the Sanitary Authority in whose district the factory or workshop is situate; and it shall be the duty of the Sanitary Authority to make such inquiry into the subject of the notice, and take such action thereon as to that Authority may seem proper for the purpose of enforcing the law. An Inspector under this Act may, for the purposes of this section, take with him into a factory or a workshop a Medical Officer of Health, Inspector of Nuisances, or other officer of the Sanitary Authority.

Factory and Workshop Act, 1891.

2. (1) Section 4 of the principal Act shall apply to workshops conducted on the system of not employing any child, young person, or woman therein, and to laundries.

(2) Where notice of an act, neglect, or default is given by an Inspector under the said Sec. 4, as amended by this Act, to a Sanitary Authority, and proceedings are not taken within a reasonable time for punishing or remedying the act, neglect, or default, the Inspector may take the like proceedings for punishing or remedying the same as the Sanitary Authority might have taken, and shall be entitled to recover from the Sanitary Authority all such expenses in and about the proceedings as the Inspector incurs, and are not recovered from any other person, and have not been incurred in any unsuccessful proceedings.

Factory and Workshop Act, 1895.

Sec. 3. (1) Where notice of an act, neglect, or default is given by an Inspector under Sec. 4 of the principal Act to the Sanitary Authority, it shall be the duty of the Sanitary Authority to inform the Inspector of the proceedings taken in consequence of the notice.

(2) In Sec. 2 of the Act of 1891 for the words "within a reasonable time" shall be substituted the words "within one month."

Factory and Workshop Act, 1891.

Sec. 1. (1) If the Secretary of State is satisfied that the provisions of the law relating to public health as to effluvia arising from any drain, privy, or other nuisance, or with respect to cleanliness, ventilation, overcrowding, or limewashing are not observed in any workshops or class of workshops (including workshops conducted on the system of not employing any child, young person, or woman therein) or laundries, he may, if he thinks fit, by order, authorise and direct an Inspector or Inspectors under the principal Act to take, during such period as may be mentioned in the order, such steps as appear necessary or proper for enforcing the said provisions. (2) An Inspector authorised in pursuance of this section shall, for the purpose of his duties, have the same powers with respect to workshops and laundries to which this section applies, as he has under the principal Act as amended by this Act with respect to factories, and may for the same purpose take the like proceedings for punishing or remedying any default in compliance with the said provisions of the law relating to public health as might be taken by the Sanitary Authority of the district in which the workshops or laundries are situate, and shall be entitled to recover from that Sanitary Authority all such expenses in and about any proceedings in respect of such workshops or laundries as he may incur and are not recovered from any other person, and have not been incurred in any unsuccessful proceedings.

Public Health (London) Act, 1891.

Sec. 26. (1) Secs. 34, 35, and 81 of the Factory and Workshop Act, 1878, and Secs. 15 and 16 of the Factory and Workshops Act Amendment Act, 1883 (which relate to cleanliness, ventilation, and other sanitary conditions), shall, as respects every bakehouse which is a workshop, be enforced by the Sanitary Authority of the district in which the bakehouse is situate, and they shall be the local authority within the meaning of those sections.

(2) For the purpose of this section, the provisions of this Act with respect to the admission of the Sanitary Authority and their officers into any premises for any purpose in relation to nuisances shall apply in like manner as if they were herein re-enacted and in terms made applicable to this section, and every person refusing or failing to allow the Sanitary Authority or their officer to enter any premises in pursuance of these provisions for the purposes of this section shall be subject to a fine.

Factory and Workshop Act, 1878.

Sec. 34. Where a bakehouse is situate in any city, town, or place, containing, according to the last published census for the time being, a population of more than five thousand persons, all the inside walls of the rooms of such bakehouse, and all the ceilings or tops of such rooms (whether such walls, ceilings, or tops be plastered or not), and all the passages and staircases of such bakehouses, shall either be painted with oil or varnished, or be limewashed, or be partly painted or varnished and partly limewashed; where painted with oil or varnished there shall be three coats of paint or varnish, and the paint or varnish shall be renewed once at least in every seven years, and shall be washed with hot water and soap once at least in every six months; where limewashed the limewashing shall be renewed once at least in every six months.

A bakehouse in which there is any contravention of this section shall be deemed not to be kept in conformity with this Act.

Sec. 35. Where a bakehouse is situate in any city, town, or place containing, according to the last published census for the time being, a population of more than five thousand persons, a place on the same level with the bakehouse, and forming part of the same building, shall not be used as a sleeping place, unless it is constructed as follows, that is to say:—

Unless it is effectually separated from the bakehouse by a partition extending from the floor to the ceiling; and

Unless there be an external glazed window of at least nine superficial feet in area, of which at the least four-and-a-half superficial feet are made to open for ventilation.

Any person who lets or occupies or continues to let, or knowingly suffers to be occupied, any place contrary to this section shall be liable to a fine not exceeding, for the first offence, twenty shillings, and for every subsequent offence five pounds.

Sec. 81. If a factory or workshop is not kept in conformity with this Act, the occupier thereof shall be liable to a fine not exceeding ten pounds.

The Court of Summary Jurisdiction, in addition to or instead of inflicting such fine, may order certain means to be adopted by the occupier, within the time named in the order, for the purpose of bringing his factory or workshop into conformity with this Act; the Court may, upon application, enlarge the time so named, but if, after the expiration of the time as originally named or enlarged by subsequent order, the order is not complied with, the occupier shall be liable to a fine not exceeding one pound for every day that such non-compliance continues.

Factory and Workshop Act, 1883.

Sec. 15. It shall not be lawful to let or suffer to be occupied as a bakehouse, or to occupy as a bakehouse, any room or place which was not so let or occupied before the first day of June, one thousand eight hundred and eighty-three, unless the following regulations are complied with :—

(1) No water-closet, earth-closet, privy, or ashpit, shall be within or communicate directly with the bakehouse.

(2) Any cistern for supplying water to the bakehouse shall be separate and distinct from any cistern for supplying water to a water-closet.

(3) No drain or pipe for carrying off fœcal or sewage matter shall have an opening within the bakehouse.

Any person who lets or suffers to be occupied or who occupies any room or place as a bakehouse in contravention of this section shall be liable, on summary conviction, to a fine not exceeding forty shillings, and to a further fine not exceeding five shillings for every day during which any room or place is so occupied after a conviction under this section.

Sec. 16. Where a Court of Summary Jurisdiction is satisfied on the prosecution of an Inspector or a Local Authority, that any room or place used as a bakehouse (whether the same was or was not so used before the passing of this Act) is in such a state as to be on sanitary grounds unfit for use or occupation as a bakehouse, the occupier of the bakehouse shall be liable, on summary conviction, to a fine not exceeding forty shillings, and on a second or any subsequent conviction not exceeding five pounds.

The Court of Summary Jurisdiction, in addition to or instead of inflicting such fine, may order means to be adopted by the occupier, within the time named in the order, for the purpose of removing the ground of complaint. The Court may, upon application, enlarge the time so named, but if, after the expiration of the time as originally named or enlarged by subsequent order, the order is not complied with, the occupier shall be liable to a fine not exceeding one pound for every day that such non-compliance continues.

Factory and Workshop Act, 1895.

Sec. 27. (1) Secs. 34 and 35 of the principal Act shall apply to *every* bakehouse, and so much of those sections as limits the operation thereof to cities, towns, and places having a population of more than 5,000 persons, shall be repealed.

(2) In Sec. 15 of the Factory and Workshop Act, 1883, the words "which was not so let or occupied before the 1st day of June, 1883," shall be repealed.

(3) A place underground shall not be used as a bakehouse unless it is so used at the commencement of this Act, and if any place is so used in contravention of this Act, it shall be deemed to be a workshop not kept in conformity with the principal Act.

Factory and Workshop Act, 1895.

Sec. 22. (1) In any laundry carried on by way of trade, or for purpose of gain, the following provisions shall apply:—

* * * *

(*iv.*) So far as regards sanitary provisions, safety, accidents, the affixing of notices and abstracts, and the matters to be specified in such notices (so far as they apply to laundries), notice of occupation of a factory or workshop, powers of Inspectors, fines, and legal proceedings for any failure to comply with the provisions of this section, and education of children, the Factory Acts shall have effect as if every laundry in which steam, water, or other mechanical power is used in aid of the laundry process were a factory, and every other laundry were a workshop; and as if every occupier of a laundry were the occupier of a factory or of a workshop.

* * * *

(3) Nothing in this section shall apply to any laundry in which the only persons employed are—

(*a*) Inmates of any prison, reformatory, or industrial school, or other institution for the time being subject to inspection under any Act other than the Factory Acts; or

(*b*) Inmates of an institution conducted in good faith for religious or charitable purposes; or

(*c*) Members of the same family dwelling there, or in which not more than two persons dwelling elsewhere are employed.

Public Health (London) Act, 1891.

Sec. 27. If any child, young person, or woman is employed in a workshop, and the Medical Officer of the Sanitary Authority become aware thereof, he shall forthwith give written notice thereof to the Factory Inspector for the district.

Factory and Workshop Act, 1878.

Sec. 96. The expression "child" means a person under the age of fourteen years.

The expression "young person" means a person of the age of fourteen years and under the age of eighteen years.

The expression "woman" means a woman of eighteen years of age and upwards.

Factory and Workshop Act, 1895.

Sec. 29. (1) Every medical practitioner attending on or called in to visit a patient whom he believes to be suffering from lead, phosphorus, or arsenical poisoning, or anthrax, contracted in any factory or workshop, shall (unless the notice required by this section has been previously sent) send to the Chief Inspector of Factories, at the Home Office, London, a notice stating the name and full postal address of the patient, and the disease from which, in the opinion of the medical practitioner, the patient is suffering, and shall be entitled in respect of every notice sent in pursuance of this section to a fee of two shillings and sixpence, to be paid as part of the expenses incurred by the Secretary of State in the execution of the principal Act.

(2) If any medical practitioner, when required by this section to send a notice, fails forthwith to send the same, he shall be liable to a fine not exceeding forty shillings.

(3) Written notice of every case of lead, phosphorus, or arsenical poisoning, or anthrax, occurring in a factory or workshop, shall forthwith be sent to the Inspector and to the Certifying Surgeon for the district; and the provisions of the Factory Acts with respect to accidents shall apply to any such case in like manner as to any such accident as in those sections mentioned.

(4) The Secretary of State may by order made in accordance with Sec. 65 of the principal Act, apply the provisions of this section to any other disease occurring in a factory or workshop, and thereupon this section and the provisions referred to therein shall apply accordingly.

Factory and Workshop Act, 1895.

Sec. 30. (1) In every factory or workshop where lead, arsenic, or any other poisonous substance is used, suitable washing conveniences shall be provided, for the use of the persons employed in any department where such substances are used.

(2) A factory or workshop in which there is a contravention of this section, shall be deemed not to be kept in conformity with the principal Act.

Factory and Workshop Act, 1895.

Sec. 6. If an occupier of a factory or workshop or laundry, or of any place from which any work is given out, or any Contractor employed by any such occupier, causes or allows wearing apparel to be made, cleaned, or repaired in any dwelling-house or building occupied therewith, whilst any inmate of the dwelling-house is suffering from scarlet fever or small-pox, then, unless he proves that he was not aware of the existence of the illness in the dwelling-house, and could not reasonably have been expected to become aware of it, he shall be liable to a fine not exceeding ten pounds.

Factory and Workshop Act, 1891.

Sec. 17. An occupier of a factory or workshop shall not knowingly allow a woman to be employed therein within four weeks after she has given birth to a child.

Factory and Workshop Act, 1895.

Sec. 13. Sec. 82 of the principal Act, which provides penal compensation to persons injured by neglect to fence machinery, shall extend to any death or bodily injury, or injury to health in consequence of the occupier of a factory or workshop having neglected to observe any provision of the Factory Acts, or any special rule or requirement made in pursuance of the Act of 1891. Provided that in the case of injury to health the occupier shall not be liable under this section unless the injury was caused directly by such neglect.

The Public Health (London) Act, 1891.

Sec. 23. *Furnaces and steam vessels to consume their own smoke.* (1) Every furnace employed in the working of engines by steam, and every furnace employed in any public bath or wash-house, or in any mill factory, printing house, dye house, iron foundry, glass house, distillery, brewhouse, sugar refinery, bakehouse, gasworks, waterworks, or other buildings used for the purpose of trade or manufacture (although a steam engine be not used or employed therein), shall be constructed so as to consume or burn the smoke arising from such furnace.

(2) If any person being the owner or occupier of the premises, or being a foreman or other person employed by such owner or occupier (*a*) uses any such furnace which is not constructed so as to consume or burn the smoke arising therefrom; or (*b*) so negligently uses any such furnace as that the smoke arising therefrom is not effectually consumed or burnt; or (*c*) carries on any trade or business which occasions any noxious or offensive effluvia, or otherwise annoys the neighbourhood or inhabitants without using the best practicable

means for preventing or counterbalancing such effluvia or other annoyance; such person shall be liable to a fine not exceeding five pounds, and on a second conviction to a fine of ten pounds, and on each subsequent conviction to a fine double the amount of the fine imposed on the last preceding conviction.

* * * *

(4) Provided that in this section the words "consume or burn the smoke" shall not be held in all cases to mean "consume or burn all the smoke," and the Court hearing an information against a person may remit the fine if of opinion that such person has so constructed his furnace as to consume or burn as far as possible all the smoke arising from such furnace, and has carefully attended to the same and consumed or burned as far as possible the smoke arising from such furnace.

(5) It shall be the duty of every Sanitary Authority to enforce the provisions of this section, and an information shall not be laid for the recovery of any fine under this section, except under the direction of a Sanitary Authority.

(6) The provisions of this Act with respect to the admission of the Sanitary Authority into any premises for any purposes in relation to nuisances, and with respect to the giving of information of a nuisance, shall apply in like manner as if they were herein re-enacted, and in terms made applicable to this section.

* * * *

Sec. 24. (*a*) Any fireplace or furnace which does not as far as practicable consume the smoke arising from the combustible used therein, and which is used for working engines by steam, or in any mill, factory, dyehouse, brewery, bakehouse, or gaswork, or in any manufacturing or trade process whatsoever; and (*b*) Any chimney (not being the chimney of a private dwelling-house) sending forth black smoke in such quantity as to be a nuisance; shall be nuisances liable to be dealt with summarily under this Act, and the provisions of this Act relating to those nuisances shall apply accordingly.

Provided that the court hearing a complaint against a person in respect of a nuisance arising from a fireplace or furnace which does not consume the smoke arising from the combustible used in such fireplace or furnace, shall hold that no nuisance is created, and dismiss the complaint if satisfied that such fireplace or furnace is constructed in such manner as to consume as far as practicable, having regard to the nature of the manufacture or trade, all smoke arising therefrom, and that such fireplace or furnace has been carefully attended to by the person having the charge thereof.

APPENDIX B.

The Leading Sections of the various Acts of Parliament compared as to their Metropolitan and Extra-Metropolitan application.

METROPOLITAN.	EXTRA-METROPOLITAN.
Definitions.	
F. & W. A., 1878, Sec. 93.	Same.
„ „ Sch. 4.	„
„ „ Sec. 97.	„
„ „ Sch. 5.	„
„ 1891, Sec. 37 (2).	„
„ 1878, Sec. 16.	„
Notices and H.M. Inspectors.	
F. & W. A., 1891, Sec. 26.	„
„ 1895, Sec. 41.	„
Outworkers.	
F. & W. A., 1891, Sec. 27.	„
„ „ (Order 4 Nov. '92).	„
„ 1895, Sec. 42.	„
Nuisances.	
P. H. L. A., 1891, Sec. 10 (entry.)	P. H. A., 1875, Sec. 102 (entry). F. & W. A., 1891, Sec. 3 (2).
„ „ Sec. 2.	P. H. A., 1875, Sec. 91. F. & W. A., 1891, Sec. 4 (1).
F. & W. A., 1895, Sec. 1.	Same.
„ 1878, Sec. 78.	„
„ „ Sec. 96.	„
„ „ Sec. 61 (3) (*a*).	„
„ 1895, Sec. 1 (3).	„
„ „ Sec. 32.	„
P. H. L. A., 1891, Sec. 25.	F. & W. A., 1891, Sec. 4 (2), (3), (4).
„ „ Sec. 38.	P. H. A. A., 1890, Sec. 22. F. & W. A., 1895, Sec. 35.
F. & W. A., 1878, Sec. 4.	Same.
„ 1891, Sec. 2.	„
„ 1895, Sec. 3 (1), (2).	„
„ 1891, Sec. 1.	„
Bakehouses.	
P. H. L. A., 1891, Sec. 26 (entry &c.)	F. & W. A., 1883, Sec. 17 (1) (entry, &c.)
F. & W. A., 1878, Sec. 34.	Same.
„ „ Sec. 35.	„
„ „ Sec. 81.	„
„ 1883, Sec. 15.	„
„ „ Sec. 16.	„
„ 1895, Sec. 27.	„
Laundries.	
F. & W. A., 1895, Sec. 22.	„

METROPOLITAN.	EXTRA-METROPOLITAN.
Notices by M.O.H. as to Protected Persons.	
P. H. L. A., 1891, Sec. 27.	F. & W. A., 1891, Sec. 3 (3).
F. & W. A., 1878, Sec. 96 (part).	Same.
Notification.	
F. & W. A., 1895, Sec. 29.	„
Lavatories.	
F. & W. A., 1895, Sec. 30.	„
Infectious Disease and Clothing.	
F. & W. A., 1895, Sec. 6.	„
Injury to Health.	
F. & W. A., 1891, Sec. 17.	„
„ 1895, Sec. 13.	„
Smoke.	
P. H. L. A., 1891, Sec. 23.	P. H. A., 1875, Sec. 102.
„ „ Sec. 24.	„ „ Sec. 91 (7).
Fire Escapes.	
F. & W. A., 1891, Sec. 7 (4).	F. & W. A., 1891, Sec. 7 (1), (2), (3).

Prof. W. H. CORFIELD (London), moved that a hearty vote of thanks be accorded to Dr. Sykes for his especially valuable paper on a subject of the most direct importance at the present time. In reference to bakehouses, Dr. Sykes had said that the regulations as to drain-openings inside should be more clearly defined—as to whether any drain-opening is at all allowable in a bakehouse. In St. George's, Hanover Square, they adopt the view that no opening of any kind is allowable, for the words are: "That no drain or pipe for carrying off fœcal or sewage matter has an opening in the bakehouse." And certainly a gully is an opening to a drain, even if the gully itself is not used for sewage matter at all. Another important point dealt with is the affixing of a notice specifying the number of persons to be permitted in each room. The Inspector of Factories does not know the size of the room, or the number of persons allowable in it. The Sanitary Inspector measures the room, and the best way, perhaps, of getting over the difficulty is for the Sanitary Authority to prepare cards properly filled in. Then if there be any difficulty about the Sanitary Authority insisting on the cards being affixed, the Factory Inspector can insist upon it. The act having to be administered partly by the Sanitary Authorities and partly by the Factory Inspectors, it is necessary that they should work harmoniously; that this will be so is to be sincerely wished, and the recent appointment of so experienced a Medical Officer of Health as Dr. Whitelegge, to the position of Chief Inspector of Factories, is a matter of congratulation in every way.

A. MACKIE (London) had much pleasure in seconding the vote of thanks. As an Inspector of Factories he felt there were difficulties in the way of notice being affixed by the Sanitary Authority. Sanitary Authorities had no power to require a card to be affixed, as the Secretary of State had specified the form (Form 46) to be used. Besides, he doubted if the card of a Sanitary Authority would be accurate, as it would imply that so many might work overtime in a place where it would be illegal for any woman to so work. Again, who is to enforce the regulation as to the 400 cubic feet space? How is the Sanitary Inspector to know if the persons are working overtime, for it is quite possible that in one workshop they might be working after (say) eight o'clock at night, and yet legally so; while in another, the work might be done illegally. With regard to Outworkers, Dr. Sykes seemed to imply that it was hardly necessary for visits to them on the part of the Factory Inspector, as sanitation was the chief point to be aimed at, but he could assure the ladies and gentlemen present, that it was due to the Out-workers' Lists that the large number of sweating dens in East London had been discovered, and the disgraceful system stopped. He questioned whether the Sanitary Inspector had a right to enter a domestic workshop as a workshop; as he was under the impression that his only right of entry was as to a private dwelling house.

Dr. LOUIS PARKES (London) considered that the paper read by Dr. Sykes clearly pointed out the necessity of the codification of the Factory and Workshops Acts, so as to facilitate the work of the Sanitary Authority, upon whose work the health of the people of the Metropolis so largely depended. The Government Department was in his opinion considerably undermanned, and he failed to see how the Factory Inspector could possibly supervise a tithe of the places under his supervision. What is really wanted is an amplification and codification of the present Acts, and the appointment of men and women to specially undertake the Inspection of Factories within their districts.

Dr. H. R. KENWOOD (London) remarked that in Stoke Newington they had recently completed the Register of Factories and Workshops, and the most important duty of affixing and filling up the schedules of the number of persons allowable in each room, had been exercised in every instance by the Local Authority. He believed that if this task had been left in other hands it would not have been performed with anything approaching the same dispatch. He attached special importance to the matter of cubic area, because he felt it to represent, along with the provision enforcing a reasonable temperature, the most important advance in recent factory legislation; the power now exists of ensuring that the workers shall work in properly ventilated premises, kept at a reasonable temperature and not overcrowded, and it was safe to predict that by the exercise of this power a considerable amount of preventable illness will be spared the wage-earning community.

Brigade-Surgeon Lieut.-Colonel PRINGLE (London), said the very important question of preventable illness among those employed in factories and workshops was the main point under discussion, and its bearing on the general health of the community could not be exaggerated. Dr. Pringle had been very much struck by the work done in Kensington in the laundries, and there could be no question that for hard work, and work of a trying character, laundry-work is the foremost, owing to the great variations of temperature, the difficulty of heating the irons without vitiating the air; and the difficulty of getting rid of the excess of steam even in the case of the most *up-to-date* laundries in public institutions. He felt that anything that was suggested to mitigate the evils of the laundries should be carefully considered, and here the Lady Inspector filled an important and responsible position, and could prove exeeedingly useful and valuable in the administration of the Laws. Whether the Factory Inspector, or the Medical Officer of Health, or the Sanitary Inspector did the work, it was of vital importance that they should all work in perfect harmony, for he was certain if mutual arrangements could be made, the work would be more efficiently carried out. So with the existence of infectious disease, especially in a crisis, the utmost unanimity should exist to enable arrangements, such as those of the Ambulance Department of the Metropolitan Asylums Board, for isolation at the earliest possible moment, to be carried out in the manner so graphically described by the chairman of that Department at a late meeting of this Institute.

The CHAIRMAN (Sir Francis Sharp Powell, M.P.), congratulated the Institute upon the action of the present Government in introducing to Parliament a Bill which will put an end to the obsolete system of quarantine in this country. The bill was known as the Public Health Bill, and he hoped that in the course of a few weeks quarantine would be abolished, and that the Law would be brought into line with science and common sense. He had directed the attention of the late and of the present Government to the matter, and felt much satisfaction in the success of his efforts. Referring to the appointment of Dr. Whitelegge as Chief Inspector of Factories, he could congratulate the country on his acceptance of the position. Having known him as Chief Medical Officer of Health for the West Riding of Yorkshire (where he would be greatly missed) he felt pleased that they now had a most competent head of the Factory Department. Referring to legislation, Sir Francis said that the difficulties of the officials had been increased by the Act of 1895; and he hoped that ere long the Acts of 1878, 1891, and of 1895 would be consolidated. They were not yet nearly at the end of Factory Reform; as each year would reveal new difficulties, and show how better to overcome old existing difficulties. The workers were advancing from one condition to a higher; and the improvement in the Laws would help forward that progress. All this should encourage them to struggle on. Much might be done by legislation, but much more would be accomplished by mutual confidence between employer and employés. Let them improve the laws as circumstances showed it to be advisable to do so; but however perfect Acts might be in the eyes of the Legislator, it was only by the willing co-operation of the worker that they could be successfully carried out.

In replying to several points in the discussion, Dr. **Sykes** said that they felt very thankful to Professor Corfield for his pronouncement on the question of gully openings in bakehouses, as an opinion from so eminent an authority must have considerable value. With regard to the remarks of Mr. Mackie in reference to cards affixed in workrooms by Sanitary Authorities being illegal he hardly grasped the reason why, for there were many points in the Act which might be regarded as illegal from a given standpoint, yet perfectly legal if permitted by the only person possible to aggrieve. The difficulty of finding out workshops was the initial one, and equally so for the Sanitary Inspector and the Factory Inspector alike. With reference to the supervision of out-workers the Sanitary Inspector can enter any premises, his power being covered by the Entry Sections of the Public Health Acts. As Brigade-Surgeon Pringle observed, the real basis of the whole question is health.

REVIEWS OF BOOKS.

PUBLIC HEALTH IN EUROPEAN CAPITALS (BERLIN, PARIS, BRUSSELS, CHRISTIANIA, STOCKHOLM, AND COPENHAGEN.)*

This Volume, the bulk of which has already appeared in various periodical publications, contains a very interesting comparative study of Public Health Administration in the European Capitals mentioned in the title. Dr. Legge is an impartial critic, but the British reader will be continually making for himself contrasts and comparisons with our own arrangements to the advantage sometimes of the foreigner, sometimes of ourselves. They do not manage all things better in France, and the picture which Dr. Legge draws of the confusion of administration and the utter want of central control in France, the home of centralisation, may make the Local Government Board hug itself with satisfaction, if the frivolity of the simile may be excused.

Among the most interesting passages in the book are those which describe the great sewage-farm system of Berlin, and the great scheme for disposing of the sewage of Paris on the same principle. Berlin was much favoured by its situation, unlimited opportunity being afforded by the sandy wastes by which it was surrounded; these, or certain parts of them, have been now transformed into fertile fields. Among the products of the farms are wheat, oats, barley, rape, mangolds, potatoes, fruit, and even attar of roses! Convalescent Homes, Consumption Hospitals, and labour colonies have been established on the farms; and so complete has been the success of the management, that as a rule the working expenses have been covered by the sale of the produce. Paris however is much less fortunate, but the difficulty has been grappled with. One farm 1,850 acres is already in use, and an area of 20,000 acres will be available in 1900. Meanwhile London may be expected to continue its present extravagant and irrational system well into the coming century. The practical application of bacteriological examination to the control of the efficiency of filtration of water supplies is in full force in connection with the Berlin water, and also at Stockholm, where Ekendahl however lays more stress on the number of varieties in the filtrate than on the actual number of bacteria, on the ground that certain harmless bacteria have a peculiar faculty of developing in the filter beds.

The description which Dr. Legge gives of the public slaughter-houses of Berlin and Paris, and the very elaborate control exercised by the public authority, is a proof of the great importance attached to meat inspection abroad. In Berlin especially the arrangements are remarkably thoroughgoing. The fact that trichinosis is so prevalent in pigs in Germany that one out of every 2,000 carcasses contains the parasites, taken with the German habit of eating pig's-flesh in various forms either uncooked or very imperfectly cooked, accounts for the fact that in Berlin no less than 184 microscopists are engaged daily in making examinations of pig's-flesh for trichinæ, the rule being to examine twenty-four specimens from each animal. The description of the routine of meat inspection in Berlin and Copenhagen will be found very instructive by Medical Officers of Health who may be called upon to organise a system in boroughs in this country, where as yet not very much practical experience exists.

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* By Thomas Morison Legge, M.A., M.D.(Oxon), D.P.H.(Cantab). 201 pp., 8vo. Swan Sonnenschein & Co. London, 1896. Price 3s. 6d.

Many other points have been noted for comment, but enough has been written to make it plain that Dr. Legge's small book is well worthy of perusal by those who are engaged in health administration in this country, whether as officers or members of sanitary authorities. If another edition is called for, the author would do well to revise certain looseness of style, which sometimes obscure his meaning, and to compile a more complete index, that with which the book is now provided being far too meagre for a work so full of detail as this.

If the expression of a general impression from a careful perusal of the book may be permitted, it would be that in the matter of the control of food supplies generally, but especially of meat, we in this country are so far behind others that comparison is impossible; that in house sanitation and in the collection of sewage we are in a better position, while in its disposal we are in a worse, at least in London; and finally, that in administrative arrangements we are distinctly more fortunate than other countries.

REPORT OF THE ROYAL COMMISSION APPOINTED TO ENQUIRE INTO THE EFFECT OF FOOD DERIVED FROM TUBERCULOUS ANIMALS ON HUMAN HEALTH.*

Without disparagement to the eminent men whose evidence is reported in the first part of this volume, it may be said without fear of contradiction that the most valuable part of the volume is contained in the Appendix, or Part III., in which are printed the reports of the special enquiries made for the Commission by Dr. Sydney Martin, Dr. Sims Woodhead, and Professor MacFadyean. Dr. Sydney Martin's investigation is of special value, owing to the very positive results which he obtained with regard to the infectivity of milk from tuberculous cows, and the definite opinions which he found himself justified in expressing. He says "the milk of cows with tuberculosis of the udder possesses a virulence which can only be described as extraordinary"; and the conclusion naturally follows that the milk of such cows ought not to be allowed to be consumed. As a practical measure, he recommends that the milk obtained from all cows in which (*a*) one or more quarters of the udder are enlarged or nodular, or (*b*) in which the milk from one or more quarters fails either in quantity or quality, should be at once excluded, and the cow examined by an expert. Further, he points out that every tuberculous cow must be looked upon with suspicion; for although the presence of tuberculosis of the internal organs does not confer infectivity on the milk, yet tuberculosis may develop in the udder at any stage of the general disease. Dr. Woodhead's experiments show that for the effectual destruction of the tuberculous virus in milk mere "scalding" is quite inadequate. He gives minute directions (page 177) for sterilising milk on a water-bath as follows:—

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* Report of the Royal Commission Appointed to Enquire into the Effect of Food Derived from Tuberculous Animals on Human health. Part II.: List of Witnesses, Minutes of Evidence, and Index. Part III.: Appendix, Special Inquiries. London: Eyre & Spottiswoode; Edinburgh and Glasgow: John Menzies & Co.; Dublin: Hodges, Figgis & Co. Price 7s. 3d.

> "The indications then for sterilizing milk by this method are:—
>
> (1.) That the quantity of milk should never be more than the quantity of cold water by which it is surrounded; it is an advantage in fact to have a somewhat larger bulk of water than of milk to allow for evaporation.
>
> (2.) The milk should not be covered in and should be stirred from time to time, but the water may with advantage be covered in order to prevent evaporation; this of course is arranged for in the special milk sterilizing pans.
>
> (3.) The water should be boiled over a good brisk flame in order that the best results may be obtained, and the heating process should be continued until the temperature throughout the milk has risen to from 88° C. to 92° C., in most cases this takes place at the end of about twenty-five minutes, but in order to be perfectly safe it may be recommended that every quart of milk treated in this fashion should be heated for half-an-hour, that is for about twenty minutes after the water in the outer pan has begun to boil.
>
> One great advantage of this method of sterilisation is that after the pan is placed on the fire or gas stove, it needs little attention beyond an occasional stirring until the end of the half-hour.
>
> Milk treated in this manner may be looked upon as "sterilised" and as perfectly innocuous even though it should contain the bodies of a considerable number of tubercle bacilli."

It needs no argument, however, to convince those who have experience in such matters that the only real safeguard is to exclude from a public supply milk which may by any possibility be contaminated by tuberculous virus. In an article published in the *Lancet* of October 27th, 1894, Dr. Woodhead has advanced cogent reasons for accepting the view that, in children at least, general tuberculous infection is, in very many cases, to be traced to the ingestion of infected milk, and that it is not necessary that a local lesion of the alimentary canal should be produced. The tubercle bacillus may run the gauntlet of the lymphoid tissue of the intestines and pharynx to establish itself in the mesenteric or the cervical, and finally the tracheobronchial glands, from which by a process of extension or secondary infection tuberculosis of the peritoneum, of the lungs, or a generalised acute tuberculosis may ensue. Professor MacFadyean's report deals with the means of recognising tuberculosis in animals during life. With regard to tuberculin, he is led to the opinion that to obtain trustworthy results it would be necessary to resort to a double inoculation with an interval between the injections.

D. W.

PUBLIC HEALTH LABORATORY WORK.*

This is the second edition of a small manual intended mainly for the use of students desirous of taking the Diploma of Public Health. A large part, about a third, is devoted to water analysis. Other parts of the work deal with the chemical examination of soil, of air, and of foods. A chapter on bacteriological methods is contributed by Dr. Childs. There are a good many illustrations and the work is of a convenient size. The subjects are all well treated, the descriptions clear and the matter generally well up to date. It is without doubt a most useful laboratory text book.

A. W. B.

THE LAW RELATING TO FACTORIES AND WORKSHOPS.†

This work is divided into two parts.

The first Part brings together under their several heads the substance of the provisions of the various Acts bearing upon factories and workshops, describing them in a consecutive and coherent manner. This is necessitated by the numerous cross references in the Acts that otherwise are most confusing. Here the law is presented in a readable and comprehensible form that is highly creditable to the collaborators, and will materially facilitate the labours of any Minister who may contemplate a recodification of the Acts. Exception, however, must be taken to the statement that mechanical means of ventilation are never required in a workshop. It also appears doubtful whether Section 78 of the Act of 1878 requiring an Abstract of the Act and certain notices to be affixed can be enforced "in *every* factory and workshop," as the last paragraph but one of Section 93 of the same Act excludes from the Act "such workshops other than bakehouses as are conducted on the system of not employing any child, young person, or woman therein," that is to say, where adult male labour only is employed. There are in this Part several very useful tables as to Abstracts and notices required to be affixed, registers to be kept, notices to be sent, exemptions, fees, special obligations, offences, and penalties. In an Appendix is also a full list of the Special Rules and Requirements for dangerous occupations.

Part two consists of the various Acts of Parliament set out *in extenso*, with copious notes. The sections of the Acts are complete, and not mutilated for the purpose of adapting them to later amendments, nor are the sections of one Act interpolated into another, but the amendments are shown by italics and by notes." This is a more satisfactory method than the irritating system, sometimes adopted in legal reference works, of mutilation and interpolation of such a kind as to render the law less rather than more intelligible. The notes are ample and clear. One small omission occurs in the note to Section 35 of the 1895 Factory and Workshop Act, the provision as to Sanitary conveniences in London is enforceable by the Local Authority, or *in default* by the Factory Inspector.

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* Public Health Laboratory Work, by Henry R. Kenwood, M.B., D.P.H. 8vo., 453 pp. H. K. Lewis, 1896. Price 10s. 6d.

† The Law Relating to Factories and Workshops, by May E. Abraham and Arthur Llewellyn Davies. 8vo., 283 pp. Eyre and Spottiswoode. 5s.

An excellent Index is provided, in which appears all the trades and processes mentioned in the Acts, and all the special provisions referring to them, so that rapid references may be made. The heads "definitions" and "entry," however, have been omitted.

Taking this work as a whole, the few trifling omissions mentioned are of small consequence, and the volume is certainly the best at present available for a clear insight into the Factory and Workshop Acts.

J. F. J. S.

THE HOUSING OF THE LABOURING CLASSES AND BACK-TO-BACK HOUSES.*

This little brochure endeavours to show what has been done in the past to provide suitable houses for the very poor or labouring classes of our larger cities, and to give some suggestions as to the description of house which is required. Numerous sketch plans of the ground floors of houses are contained in the text, and these are of the greatest assistance to the reader in enabling him to comprehend the views of the author, who is himself an authority of the highest kind on the subject of which he treats.

We are strongly of Mr. Boulnois' opinion that there is no financial reason why back-to-back houses should be built for the purpose of housing the labouring classes. Through ventilation for all such dwellings is a necessity, and it is nothing less than criminal for Sanitary Authorities, in the light of existing knowledge, to frame bye-laws which permit the erection of caves as dwellings. The author also thinks that it is unnecessary to house people in large blocks of buildings. He says the aim should be to provide self-contained, cheap, sanitary, and cheerful houses at reasonable rentals, and that the labouring population of our large towns should be induced by cheap means of locomotion to spread themselves, rather than to crowd together in large over-populated centres.

L. C. P.

THE HOUSING OF THE WORKING CLASSES.†

This is an eminently readable treatise on one of the social questions of the day. Dr. Bowmaker brings knowledge and common sense to bear on the subject, and his remarks are worthy of the careful attention of those alike who have the making and the administration of Acts of Parliament. One of the remedies proposed for the evils attending the old and existing methods of housing our town populations is decentralisation and the diffusion of displaced populations in the suburban areas. To those who are acquainted with the manufactory of metropolitan suburban slums, which is now going on in many districts, this remedy seems only to be a transference of nuisance from one spot to another. It is true that the central districts of London are being gradually cleansed of their worst slums, but it is more than probable that the condition of some of the suburban areas will demand the attention of the next Royal Commission in a greater degree than the central congested districts. A more promising suggestion is the proposal to transfer the manufactories and works themselves, that give employment to such vast numbers, to the country districts. As Dr. Bowmaker remarks, there seems to be no reason why this should not be done. The enormous extension of our railway systems, which in the first instance are responsible for so much of the existing pressure and overcrowding in towns, renders such decentralisation possible. This plan has already to a limited extent been adopted by many firms, who manufacturing in the rural districts, carry on their business from offices or warehouses in the large centres. It might with advantage be put more largely into practice. Dr. Bowmaker's book deals with the relative advantages and disadvantages of Model Block Dwellings, Cottage Homes, Model Lodging Houses, and other modern panaceas for providing healthy homes for the workers. He gives a description of the legislation bearing upon the subject, and of the powers possessed by Sanitary Authorities under the Public Health and Housing of the Working Classes Acts. Dr. Bowmaker also emphasises the fact, which cannot be too strongly insisted upon, that the problem of housing the working classes is by no means a simple one. The workers are either artizans, labourers in regular employ, or men casually engaged. Each class requires special consideration and treatment; and then there remains the question of what is to be done for the amelioration of the condition of the "submerged tenth."

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* The Housing of the Labouring Classes, by H. Percy Boulnois, M.Inst.C.E., City Engineer, Liverpool. 8vo., 46 pp. The St. Bride Press. Price 1s.

† The Housing of the Working Classes, by Edward Bowmaker, M.D. 8vo., 286 pp. Methuen & Co., 1895. Price 2s. 6d.

L. C. P.

THE WATER SUPPLY OF BARRACKS AND CANTONMENTS.*

A very useful and carefully prepared work on a subject "second to none in importance," to quote the author's words.

His object is to assist those who have to devise a project for water supply, and those who have to carry out minor works of maintenance and repair, as well as construction, of small services for barracks and military buildings all over the world.

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* The Water Supply of Barracks and Cantonments, by Major G. K. Scott. Moncrieff, R.E., Assoc.Inst.C.E. Chatham: W. & I. Mackay & Co., 1896. 319 pp. Price 10s. 6d. nett.

He includes not only English practice but the most modern ideas from abroad, especially from America and Germany, and very conveniently gives for reference a list of works which are published, and whence most of his facts have been drawn, and generously acknowledges the help he has received from brother officers as well as from many civil engineers and medical men whose names are "as household words," and also notes some well-known manufacturing firms.

The text is illustrated by 163 figures, and at the end sixty plates are folded in and bound up with the work; the illustrations and plates are clear and sufficiently plain to excuse the author from description.

In the first three chapters the question of sources of supply, construction of wells, sinking and boring, pumps of various kinds, motive power, collection and storage are dealt with; the author in a few well chosen words, writes, that however important water supply may be to any community those whose duty it is to provide for the engineering requirements of the Army of Great Britain should devote special attention to the subject, "The supply of a pure water to the community of troops or other bodies of our fellow men is equally a matter of necessity, the end is the same, our duty is to acquaint ourselves thoroughly with the means under every form and variation."

Reservoirs and aqueducts form the subject of the next two chapters, and in these are given some useful details of construction, formulæ, and tables.

The sixth on "Purity of Water," is a notable chapter, the relative duties of the medical officer and those of the engineer are clearly defined and set out, forming a subject of considerable interest, and one which is not commonly thought out, understood nor appreciated.

The filtration of water is gone into in considerable detail and the author is very careful in giving his opinion as to the relative value of systems and materials used; water softening and miscellaneous methods of purification are shortly treated of at the close of the chapter.

Theoretical principles form the subject of the next chapter, this is replete with useful formulæ and tables, all of which require to be studied in order to be appreciated at their full value.

Then follows a useful chapter on service reservoirs, their position and capacity, various forms of construction and explanatory diagrams, water towers, stand pipes and other details.

The chapter next following, on valves, service pipes, and house fittings is complete.

The watering of animals, rain-water tanks, fire protection fittings and miscellaneous apparatus described may be read with advantage, the succeeding chapter on arrangements for distribution and maintenance is very excellent and practical, and no one will disagree with the author's conclusion that "the progress of civilization in a country may be measured definitely by the perfection of the arrangements made for the supply of water to all classes of the community."

Appendices follow, the first is a report on "The failure of a masonry dam at Bouzey, near Epinal, France," by the author, followed by observations by Col. Sir J. C. Ardagh, K.C.I.E., C.B. The second is a form of specification for works in detail in connection with a water project. The third a specification for pipes for the Murree Water Works. The fourth is a memorandum on the use of hydraulic lime mortar, based upon some experiments by Mr. G. F. Deacon.

The Index is full and complete; the plates to which reference has been made close the volume.

It is not possible to read this book without profit, and to notice the desirable fact that the co-operation of the military with the civil engineer and the mutual reliance apparent tends towards a realization of the truism that the strength of a nation lies in the health of its people.

This work can be confidently recommended and should have a wide circulation among all who feel interested in water supply, whether he be soldier or civilian. L. F.

NOTES ON BOOKS AND PAPERS IN TRANSACTIONS.

"Domestic Sanitary Drainage and Plumbing." By **William R. Maguire** (of Dublin). Second Edition. 466 pp. *Kegan Paul, Trench, Trübner & Co. London*, 1896. *Price 12/-*

This volume contains a course of lectures delivered to technical teachers of plumbing, journeymen plumbers, apprentices and others, at the Central Technical Institution, South Kensington, and arranged for by the City and Guilds of London Institute, acting in conjunction with the Worshipful Company of Plumbers. The book is arranged to aid plumbers to obtain a more intelligent grasp of the questions which they may have to solve in technological examinations in plumbing, and which they must inevitably face in daily practise. The book is well and fully illustrated.

"Examination of Water for Sanitary and technic purposes." By **Henry Leffmann**, A.M., M.D., Ph.D. Third Edition. 154 pp., 8vo. *P. Blakiston, Son & Co. Philadelphia*, 1895. *Price $1.25c.*

The present edition of this work includes many of the latest processes for water analysis, such as seem of substantial value. The description of General Quantative Analysis, which follows to a large extent the methods indicated by Fresenius, have been left without any material change. The chapter on the Purification of Water describes in detail a few of the important systems, especially the Anderson Iron Process.

"Hints to Plumbers." By JOHN W. HART, R.P.C. Second Edition. 301 pp., 8vo. *Smith, Greenwood & Co. London,* 1896. *Price 7/6*

As the title implies, this book is not a full and exhaustive treatise on plumbers' work generally, but is rather in the form of a practical text book on some of the most popular branches of the plumbing trade, such as joint wiping, pipe bending, and lead burning. The various methods and tools used are fully illustrated, and the book is clearly printed.

"Analysis of Milk and Milk Products." By HENRY LEFFMANN, M.D., P.H.D. 89 pp., 8vo. *Blakiston, Son & Co. Philadelphia,* 1893. *Price $1.25c.*

A little book providing methods of analysis suitable, not only for professional chemists, but also such as may be safely employed by dairymen and others unskilled in general analytical work.

Beside other useful tables one is added, based on the Formula of Hehner and Richmond, arranged to suit the method of calculating total solids from the fat and specific gravity.

"The Coal-Tar Colours." Translation of a Sanitary and Medico-Legal Investigation by Theodore Weyl. By HENRY LEFFMANN, M.D., Ph.D. 154 pp., 8vo. *Blakiston, Son & Co. Philadelphia,* 1892. *Price $1.25c.*

This treatise will be found more technical than is usual in articles addressed to medical and sanitary circles in this country. But though the array of formulæ and reactions may deter many from the perusal of this essay, yet the essential matter is distinctly set forth that it may be easily mastered even if the chemical portion is passed by. It will be a source of gratification to the sanitarian to find the small proportion of really injurious colours, and that those which produce marked toxic symptoms require such large doses that it is unlikely serious results could occur by accident.

The essay contains a summary of the existing legislation on the topic in the more progressive countries in Europe.

"Foods: their Composition and Analysis." By ALEXANDER WYNTER BLYTH, M.R.C.S., F.I.C., F.C.S., &c. Fourth Edition. 735 pp., 8vo. *Charles Griffin & Co. London,* 1896. *Price 16/-*

The work includes an historical account of the subjects treated, and also a review of English Legislation, past and present, relative to adulteration. The book having reached the fourth edition it is hardly necessary to describe it fully. The present edition has been revised and brought up to date and a number of new tables and diagrams have been added. The composition of various goods and the apparatus used in their analysis are fully illustrated.

SANITATION IN THE MERCANTILE MARINE.

By W. G. Romeril.

(Associate.)

(Continued.)

Lower Forecastles.

Lower forecastles, whether in wooden or iron vessels, have so many disadvantages as crew quarters, that it will be as well to deal with these in detail, and show by diagrams how the principles of the Merchant Shipping Act, 1867, with reference to crew spaces are frequently disregarded. Had the spirit of the Act been strictly carried out such quarters for the crew would now be swept away. The new Merchant Shipping Act, 1894, in this respect differs in no way from the former Act, for the sixth schedule to this Act provides that all crew spaces shall be:—

Securely constructed;
Properly lighted;
Properly ventilated;
Properly protected from weather and sea;
As far as practicable properly shut off and protected from effluvium which may be caused by cargo or bilge water.

Security of Construction.

In all vessels this provision is for obvious reasons strictly complied with; as far as lower forecastles are concerned no question can be raised on this point.

Lighting.

In wooden vessels the common method of lighting these quarters is by means of glass prisms, let into the deck above, usually termed decklights.* But the facility and frequency with which these are broken or damaged by chain cables and other ship's gear, points to a great difficulty in securing proper lighting by this means. Moreover the parts of the deck, which would be, under other circumstances, best adapted to such a purpose are, as a rule, in the shade and therefore unsuitable.

Another common method of lighting is by side ports, but with these the rays of light, having a lateral direction only, are obstructed by bunks, &c. With vessels which have a top gallant forecastle deck, this would be the only means available. The scuttle or companion hatch cannot be depended on, as in a head sea or bad weather it would be closed. The same drawback exists in iron vessels with the addition that the deck overhead is of iron, which results in the side ports being relied upon for the purpose of lighting.

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* Commonly called "deadlights" by seamen.

VENTILATION.

Sir James Clarke in his work "The Sanitary Influence of Climate," states:—"To understand the proper method of ventilating we have only to attend to the currents which take place naturally in all inhabited rooms. Air, as it increases in temperature or becomes loaded with watery vapours, has its weight diminished and ascends. Now the air in an inhabited apartment being both heated and generally combined with a portion of watery vapours from respiration, &c., becomes specifically lighter, at the same time that it is vitiated, and rises to the roof. If it had the means of escape it would be gradually forced out by an equal quantity of pure and more dense air entering from below, which in its turn becoming heated and deteriorated, would in like manner ascend and make its escape, thus would a continual current of the air go without any trouble on our part. Unless provision be made for the escape of the ascending current of impure air, no admission of external air will secure proper ventilation."

From the following table by Professor de Chaumont, it will be seen that the increase of impure air is greater in the smaller spaces than in the larger.

	Ratios of impurity found in Spaces of 1000 c. ft.	Spaces of 500 c. ft.
After 1 hour ..	0·12 per cent.	0·18 per cent.
„ 2 hours ..	0·18 „	0·30 „
„ 3 „ ..	0·24 „	0·42 „
„ 4 „ ..	0·30 „	0·54 „
„ 6 „ ..	0·42 „	0·78 „
„ 7 „ ..	0·48 „	0·90 „

If such is the case on shore where windows and doors are available how much more impure must air be in lower forecastles situated in the bows of a vessel where the inlet and outlet are both overhead. In bad weather it is probable that all ventilation will be closed, in which case there is only the scuttle or companion hatch to be depended on. Ventilation! under these conditions may be considered non-existent. This is without a doubt the greatest evil that attaches to places below deck, and will apply both to wooden and iron vessels.

PROTECTION FROM WEATHER AND SEA.

A leaky deck is a common source of great discomfort and is mainly due to the working and straining of windlass, bitts, and the dragging of cables over the deck, but, beyond this, lower forecastles may be considered sufficiently protected from weather and sea.

In iron vessels a further nuisance is caused by the non-insulation of stringer plates immediately over bunks.

EFFLUVIUM FROM CARGO AND BILGE.

From a hygienic point of view this provision remains to the present day, practically a dead letter, the words *as far as practicable* are taken in a liberal spirit, and it would be difficult to find a lower forecastle without effluvium from cargo or bilges. This is mainly in consequence of defective bulkheads, insufficiently caulked linings and forecastle floors, and to render these tight is next to impossible. From the constant straining of the vessel, the hull of a ship is continually on the work. This will be worse when plunging in a heavy head sea, at which time the labouring and straining will probably be severe. When lying becalmed, heavy rolling will have more or less the same effect. In port it will occur from the distribution of cargo in holds and grounding on uneven bottoms.

In iron vessels a considerable difference is found in the construction. The divisional bulkhead, or as it is commonly termed the collision bulkhead, is of iron, and is generally tight. The space between frames abreast of deck stringers is cemented, and so cutting off the bilge in this direction, yet this is liable to become defective and is seldom renewed.

Fig. 7 will show what is common to most lower forecastles. The hidden bilge (*a*) (*a*) (*a*) is probably the worst feature to deal with. The difficulty with this is that it cannot be thoroughly cleansed. The older the vessel, the more liable will this be to pollution from impurities due to decay and other causes. (*b*) is the coal locker below the forecastle floor, access to which is usually by an ill-fitting hatch. The floor (*e*) from constant traffic is never properly tight, and any water spilt or used for cleansing purposes finds its way into the coal and chain lockers (*c*). There is always a certain amount of mud adhering to the cable which increases the nuisance. The consequence is that immediately below the floor, we have a damp mass giving off a most unpleasant smell. The foul air arising from the bilges finds its way between the frames and through the uncaulked and defective lining (marked by arrows in Fig. 8), which may have been caulked when the vessel was new, but is seldom renewed afterwards. Taking into consideration the fact that bunks, where men have to sleep, and food lockers, where the daily and weekly provisions are stored, are built up against this lining, it can well be imagined that the existence of "poor Jack" in these stuffy and malodorous places is not to be envied.

Another source of trouble which does not add to the salubrity of the place, is the ship's and boatswain's stores, kept in lockers or in some cases even under the bunks.

Allusion has already been made to the leaky deck caused by the working of the windlass.

With regard to cubic space, the amount found in most of these vessels comes well within the provision of the Merchant Shipping Act.

Fig. 9 represents a lower forecastle common to small steam vessels in the coasting trade. The top gallant forecastle deck renders it difficult to ensure proper lighting, the side scuttles are the only means available, a method open to many objections as the rays of light are obstructed by bunks, &c.; the floor in all cases being in the dark, a matter of no little importance where cleanliness is concerned.

Below the floor is the forepeak wherein will be stowed cargo gear, ship's stores, and old and disused ropes, &c. The chain locker at the after end of the peak presents the same nuisance as in Fig. 7, access to both these places is in most cases from the forecastle by an ill-fitting hatch. At each side on the after end is a pipe (untrapped) leading direct to the bilge.

The law as affecting the question of tonnage proves rather a stumbling block to sanitation, because in fulfilling the requirements laid down by the Merchant Shipping Act, lower forecastles may be deducted from the register tonnage, a fact which the shipowner is not slow to recognise, as it is upon the registered tonnage that port dues, &c., are calculated. Yet it is to be hoped that when the insanitary condition of these places is fully appreciated by owners, they will take it upon themselves to erect quarters on deck, thus conferring a blessing on those whose calling is, at the best of times, without many of the comforts of existence.

Scandinavians, Dutch and Germans are a long way ahead of the British Mercantile Marine in this respect, as we find few such places in their vessels. It is said that this is due to their timber trade. The bow port is used in shipping the timber, which thus passes through the space where the lower forecastle would be situated. This may be, but from the author's experience the crew quarters on these vessels have no fault in common with lower forecastles.

UPPER OR TOPGALLANT FORECASTLES.

Owing to their position above the main deck, and freedom from sources of pollution common to lower forecastles, these places possess many advantages as crew spaces.

The improvement effected of late in these forecastles, augurs well for the future of "Sailor Jack." Still there is much to be done. The windlass, that at one time was an encumbrance, together with its accompanying hawsepipe nuisance,* is slowly giving way to improved mechanical arrangements. Situated as these quarters are in the bows, where in bad weather or plunging into a head sea, the conditions are worse than in any other part of the vessel, the need of efficient and continuous ventilation is most desirable. Lighting is as a rule not properly regulated, too much dependence being placed in side ports and decklights. The seamen's *bête-noir* is the fore-peak hatchway, which is situated in the forecastle. The daily traffic to and from this place causes endless annoyance and friction between officers and men. The position of food lockers too requires more consideration, as they are frequently found built up against the partition of paint and lamp lockers, and in some instances against that of a closet. Paint and lamp lockers should never adjoin living rooms, unless protected by an iron bulkhead. In warm climates, iron decks, when exposed to the direct action of the sun's rays, become exceedingly hot, the heat by conduction increases the temperature in crew spaces and adds to the discomfort of the men.

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* Captain D. Wilson Barker, R.N.R., in a letter read before the members of The London Shipmasters' Society at the Fishmonger's Hall, cites the following amusing description of the top gallant forecastle of a ship bound down Channel in winter. "If fortunate enough to have secured an upper bunk you could recline at ease, watch the sea rushing through the hawseholes at every dive the ship made, and by the light of a glorious slush lamp see your chest and those of your shipmates ride on the crest of a wave to their own destruction and your discomfort. When at eight bells you are turned out of your nest, your mate of the tier below took your place, you found yourself in the lee scuppers, sprawling in the midst of water, soaked bread, empty beef kids, bottom boards of the lower bunks, clothing, and sundry other articles, whilst the good old ship plunged and dived, adding water to water, till the sea ran boldly out of the lee doorway, &c." This condition of things is not common now-a-days, but it does happen occasionally.

Before dealing with the arrangements in detail, it will be necessary to point out that the internal fittings of forecastles do not usually form part of the main structure of a vessel, thus making it easier to obtain the desired reform. We have merely to deal, so to say, with an empty space where fore and aft bulkheads, paint and lamp locker, boatswain's and donkeyman's berths and food lockers, *vide* Fig. 11, as a rule are left to the designs of the builders, who in this, as in other important sanitary matters, are allowed too much latitude.

It would appear by the ill-directed ventilation so commonly met with, that ventilators are only an afterthought and that conformity with the provisions of the Merchant Shipping Act irrespective of the position of ventilators is all that is needed. This is an obvious mistake. The usual practice frequently leaves much to be desired. This is due to a want of care in locating ventilators, these being invariably found immediately over or near to bunks, or in such a position that in stormy weather they have to be closed.

Ventilators can and ought to be so situated as to avoid these mistakes. To ensure a proper diffusion of air, without relying on side scuttles, and to obtain efficient ventilation, a method occurs to the writer by which the difficulty might be met, viz.:—

1st.—By having two large swan neck ventilators placed just inside the knightheads, a position affording reasonable protection, Fig. 10 and 11, (*a*) (*a*) (*a*), and connected below the deck to each side of the forecastle by a pipe.

2nd.—In the passage-way near to the doorway, Fig. 10 (*b*), on either side a cowl ventilator.

With ventilators fitted thus, it will probably be found unnecessary to close them at any time on account of the weather.

Side scuttles or ports, being in close proximity to the bunks, and closed in bad weather, cannot be relied upon for ventilating purposes.

The practice of leading bogey funnels through ventilators is to be deprecated. In wet weather water finds its way down through the opening at the flange and becomes a nuisance.

On the question of lighting by side scuttles another defect may be mentioned. The angle made by the sides of the vessel, which varies in degree in the different builds, becomes of importance, as the more oblique this is the worse it will be for lighting purposes. The rays of light being directed more to the deck overhead than elsewhere.

The utility of skylights here, as in other parts of a ship, should be considered, and there should be sufficient light to enable one to read ordinary newspaper type in all parts of the forecastle. The use of light coloured paints will assist towards this end and should not be overlooked.

Access to the fore-peak hatch is generally from the sailors' forecastle and there is much traffic to and from this place for ship's gear, boatswain's stores, cargo gear, and other materials stored in this part. Frequently cargo is stowed in forepeak and when this is the case, it must be worked through the fore-castle and the men have little chance of keeping their quarters clean. The remedy is not far to seek, as the communication to this place (the fore-peak) should be from the topgallant forecastle deck, or direct from the main deck by passage way. The only objection to the last method would be the fact of taking up too much of the crew space, Fig. 11, (*c*) (*c*). In the case of the former method, in hot climates the trunkway formed by extending the hatchway to the upper deck would, by having two trap doors in the upper part opening into forecastles, give more light and act as an air shaft.

Bunks or sleeping berths are capable of much improvement, being in nine cases out of ten overwooded, and built up in most inconceiveable places regardless of shape and dimensions.

The limited floor space 12 ft. is no doubt a drawback. Add to this the idea that because a place is certified for so many men, the same quantity of bunks are necessary, with the result that a number of sleeping berths are unoccupied. This will apply to a large number of vessels outside of the passenger trade.

Bunks should be built clear of the vessel's side or bulkhead to allow of a free current of air to surround the occupant. The length and width ought never to be less than 6 ft. 6 in. and 2 ft. 3 in. respectively. All the framework should be of iron.* The sides or rolling boards not deeper than 8 inches. To be divided off at foot and head by boarding to within 6 in. of the deck or bunk overhead. The height of the lower bunk from the floor should be calculated by the height of the forecastle, as a greater distance from the floor than the minimum 12 in. allowed by the Board of Trade is to be desired.

In Fig. 11, (*d*) (*d*), it will be seen that the food lockers in either forecastle are built up against the paint and lamp lockers respectively, a most objectionable arrangement, as the slightest flaw in the usually thin wooden partition will be sufficient to contaminate the food. These lockers should be placed near the doorway or inlet ventilator and not hidden away in a corner, where they are likely to receive the full benefit of tobacco smoke with which a forecastle is liberally fumigated.

In weekly boats, where the men have to provide their own food, a good meat safe outside the forecastle should be provided, and the common practice of hanging up meat and fish in the forecastle ought not to be allowed.

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* "Practical Hints on the Hygiene of Ships," by Dr. Collingridge, Medical Officer of Health, Port of London.

Another point is the position of lamp and paint lockers. Not only is the former place fitted with niches and lockers for all the various lamps in use, but it contains tanks in which oil is stored for daily consumption. The trimming and cleaning of the lamps is also carried on in here. If ordinary care be not taken in keeping the place clean it soon becomes foul, giving off a most unpleasant smell.

In most vessels paints are in constant use, and if the locker is situated as in Fig. 11, it will necessitate going into the forecastle, where the noxious smell of paint is under the circumstances hardly ever absent. It is therefore evident that such places should never adjoin living rooms, unless protected by an iron bulkhead. On no account should they be in crew spaces.

With the modern type of anchor, hawsepipes form an important feature in the topgallant forecastle, Fig. 10, (*e*). Owing to the heavy strain to which they are subjected they are liable to become defective and cause a serious nuisance, so that a certain amount of caution is necessary in fitting bunks near to them.

The Board of Trade instructions to Surveyors provide that, "If a privy adjoins a crew space the bulkhead should be doubled with felt between the doubling and the bulkhead."

Again, on the drainage of the forecastle "Where such drainage passes through a privy or other compartment, it will be necessary to have a pipe for the drainage to pass through such privy or compartment, with the pipe made perfectly tight through the cant or coaming of the forecastle." These are serious matters unfortunately too often overlooked at the time of building.

Greater attention should also be paid to the joint of the bulkhead at the vessel's side, which, if not hermetically sealed, will be another means of communication and one not to be ignored.

"Sweat-boards" are to be commended for the purpose of insulating iron over bunks as they are easily removed for cleansing and painting, and are easily replaced, care being taken that they be of sufficient width to overlap the bunk on either side.

Sailors' quarters should in all cases be fitted with a large oilskin locker as near to doorway as possible.

Firemen and deckhands, owing in a measure to the different nature of their work, should never be located together. The unnecessary squabbling amongst them, with reference to the cleansing of the forecastle, and the neglect which follows, condemns a practice, which, however, may be said to be restricted to small vessels. A divisional bulkhead in most cases is the only remedy and it is inexpensive.

In large sailing vessels, it is always well to have the forecastle divided, one side for the port and the other for the starboard watch.

BERTHS NEAR ENGINE-ROOM AND STOKEHOLD.

¶ The position of berths adjacent to engine-rooms and stokeholds, and in a place that cannot be at all times used for living purposes on account of heat, is a matter that requires serious attention. Unfortunately these faults are too common in our mercantile marine, the trade of which is extensively both to and in hot climates, when berths in the vicinity of these places are rendered useless for obvious reasons. Living-rooms under these circumstances offer many objections and discomforts. Members of the crew find their well-earned repose is marred by these insalubrious quarters. This is a matter in which the Administration might interest themselves, because on this in a great measure depends the question, whether an officer or engineer, if he has not had the necessary rest, can keep a good watch, the only safeguard against "napping" when on duty.

The proverbial saying on board ship that "a hot engine-room and stokehold make a hot ship," should convey to the ordinary observer a palpable meaning—there being no effect without a cause. This to a very great extent exemplifies the connection there is between living rooms, and boiler and engine-room spaces through the medium of heat, a factor up to this not sufficiently considered in locating berths. The conductive properties of iron of which everything is constructed in these departments enters largely into the subject, as by these and other means heat is conveyed to the immediate surroundings by the heat given off by boilers, steampipes, funnels, &c., through the agency of stokehold bulkheads, bunker, boiler and engine-room casings, &c. Owing to this cause crew quarters situated over boilers (main and donkey) and within the range of conductivity are for these reasons in certain trades rendered uninhabitable.

To the sanitarian this will be an additional element to contend with on board ship, and one in which numerous difficulties will have to be overcome, but with care and a strict adherence to details, improvements can be effected. At the same time it must be remembered that there are certain untenable methods in vogue for locating berths which call for speedy remedy.

The prevailing system of berthing engineers in the immediate surroundings of their departments for the sake of convenience is decidedly wrong, and the sooner this gives way to a better method the better it will be for those whose work at the best of times is trying.

Berths in engine-room and stokeholds are exposed to sudden changes of temperature, deleterious emanations from bilges, the sickly smell of oils, the moist atmosphere always present besides *the danger that may arise through a steam pipe bursting.**

Fig. 12 illustrates the position of the 1st and 2nd engineers' berths on either side of the cylinders, with doors opening out on to top platforms. These rooms are always damp. This is due to condensation. The only ventilation is by a circular lowered ventilator in the door, and the side scuttle or port, which cannot always be opened.

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* *Vide*—The accident which occurred on the S.S. Brigadier of Newcastle, offl. No. 7263, when at sea and about 40 miles from Hartlepool. On the 6th November, 1875, an explosion took place in the engine-room which resulted in the deaths of two firemen as follows:—The junk ring of the high pressed cylinder gave way, the cylinder cover in consequence being knocked off caused the steam to exhaust in engine-room. Two firemen asleep in their bunks at the time of the accident were found dead on the upper platform in endeavouring to escape from their quarters which was situated on the after part and in engine room.

Fig. 13 illustrates the crew quarters on a vessel employed in the coasting trade of this country. The seamen and firemen's quarters are over boiler tops and adjoining engine-room, the overhang of these places is about 2 ft. from boiler.* The extreme width being 6 ft. The saddle back is sloped down to within 3 ft. of the vessel's side, leaving but a narrow passage abreast of it. On the starboard side in the seamen's quarters is a steam winch exhaust tank which, when the winches are at work, becomes hot and consequently a heat generator. This tank is only protected by half-inch boarding. On the after part and adjoining the firemen's quarters on the port side abreast of cylinders in engine-room, is the 1st and 2nd engineers' berth, access to which is from the top platform. The berth is 9 ft. in length, by 6 ft. in width, and is fitted as a mess room and sleeping room combined.

The space these quarters occupy is virtually what is termed the side bunkers, the cubical capacity of which has been deducted from the register tonnage. Could not these places be used as coal bunkers in lieu of the lower side bunkers, which as a rule take up so much room in the stokehold? This indeed would be a great improvement, besides there would be no difficulty in finding better quarters for the crew.

For security and handiness, it must be admitted that berths in alleyways (Fig. 16) offer certain advantages. On the other hand there are many disadvantages, because in the typical vessel of to-day, the mode of construction and location of these berths cannot be commended. In most cases their position proves beyond a doubt a want of forethought in making allowance for local influences and climatic changes. As a matter of fact, berths are built up against stokehold and galley bulkheads. Officers and engineers' rooms and mess rooms will be found opposite to stokehold and galley doors, where also there will be closets, paint, lamp-lockers and store-rooms.

The ventilation and internal fittings of berths also shows a lack of care in the arrangements, this being frequently carried out in a most haphazard manner.

Fig. 14 represents the berths in the alleyway near the stokehold on a vessel which has been trading to the East for a number of years. The 2nd engineer's and the cook's berth amidships are adjoining the stokehold bulkhead, and immediately above the donkey boiler, Fig. 15.†

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* Captain A. G. Froud, Secretary Shipmasters' Society, in his paper entitled "Heating of Ships and Cargoes," states:—Cabins near the boiler-room, and especially if over or abreast of the boilers, are uncomfortable by reason of the heat. If used for passenger accommodation at all, these places are fit for bath rooms and lavatories only.

† Captain A. G. Froud, Secretary Shipmasters' Society, in his paper entitled "Heating of Ships and Cargoes," states:—"The overhead part of the donkey-boiler recess becomes very much heated when the boiler is in use. It has become a general practice with ship designers to place the donkey-boiler in a recess of the reserve bunks. The plan is common but without reasonable excuse."

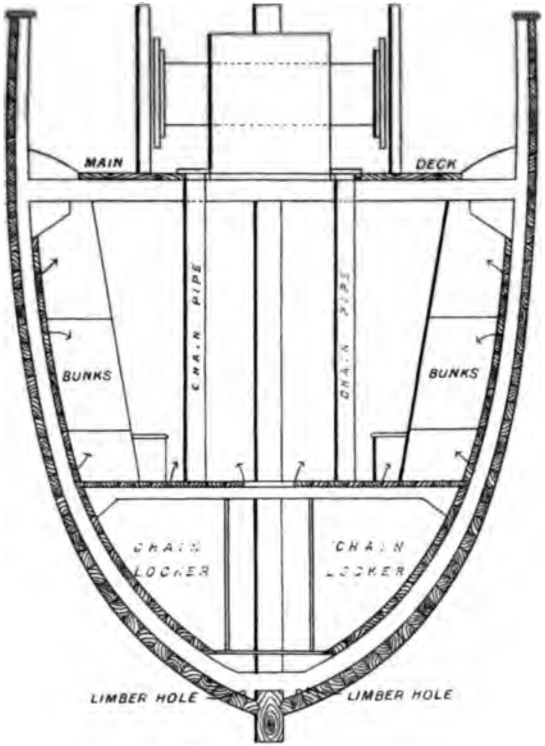


FIG 8 TRANSVERSE SECTION AT A.B. (LOOKING FORWARD).

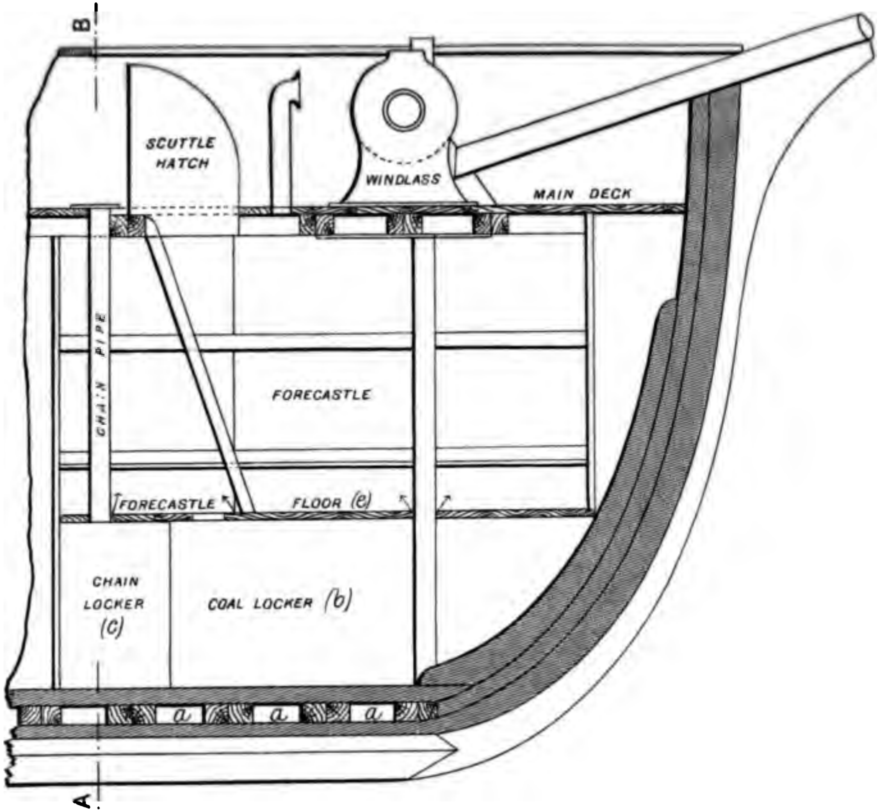
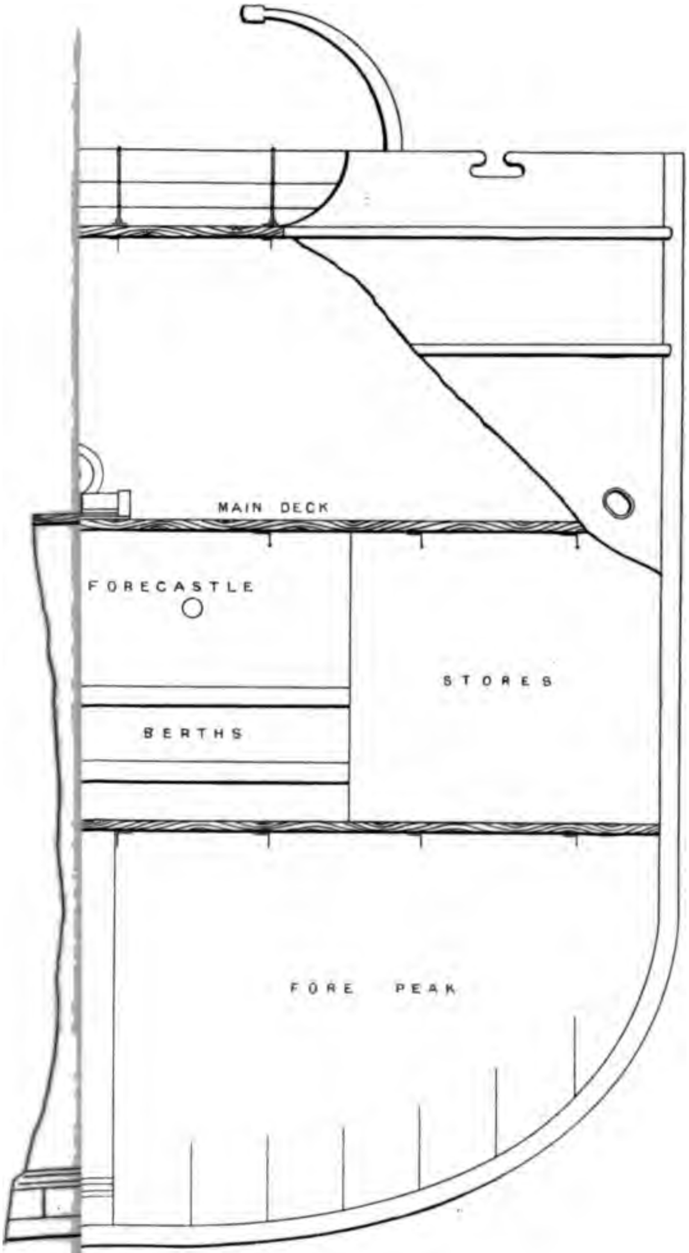


FIG. 7. SECTION THROUGH LOWER FORECASTLE.



ECASTLE.

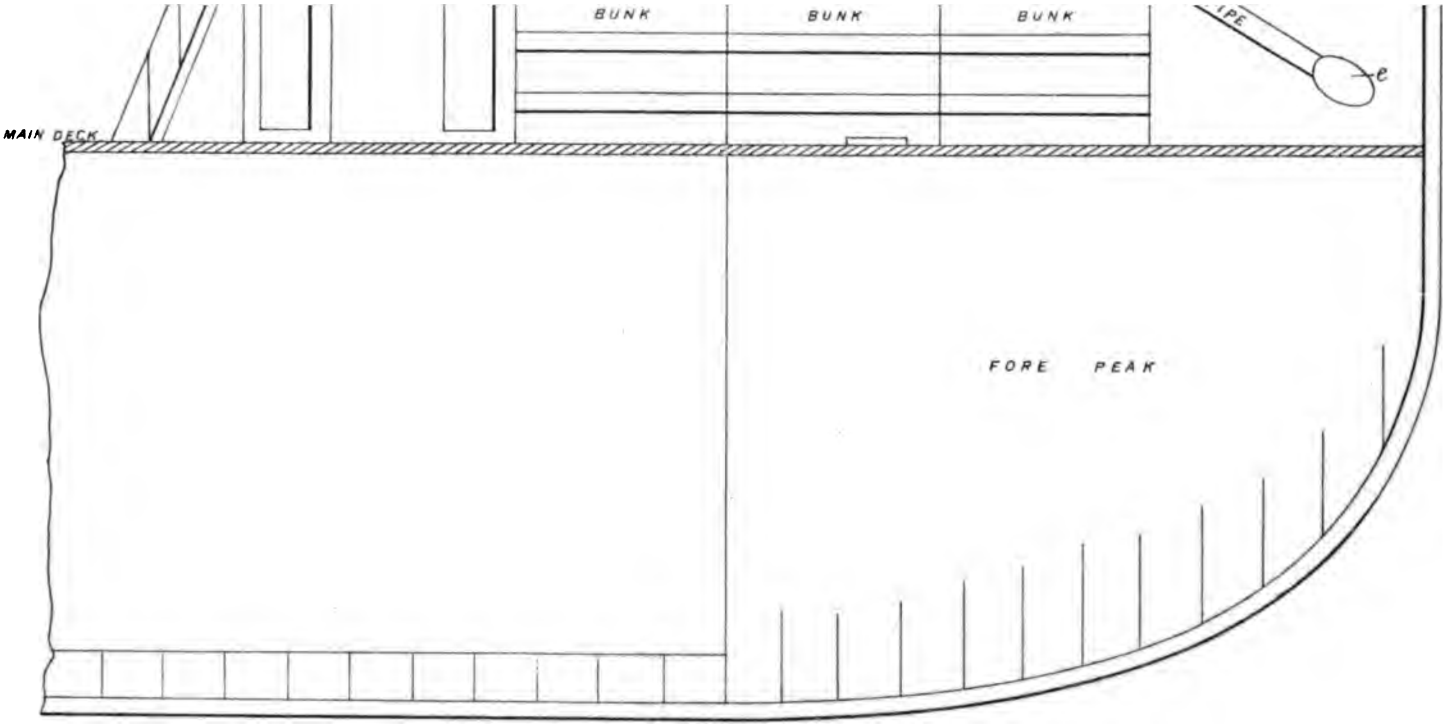


FIG. 10. SECTION THROUGH TOPGALLANT FORECASTLE.

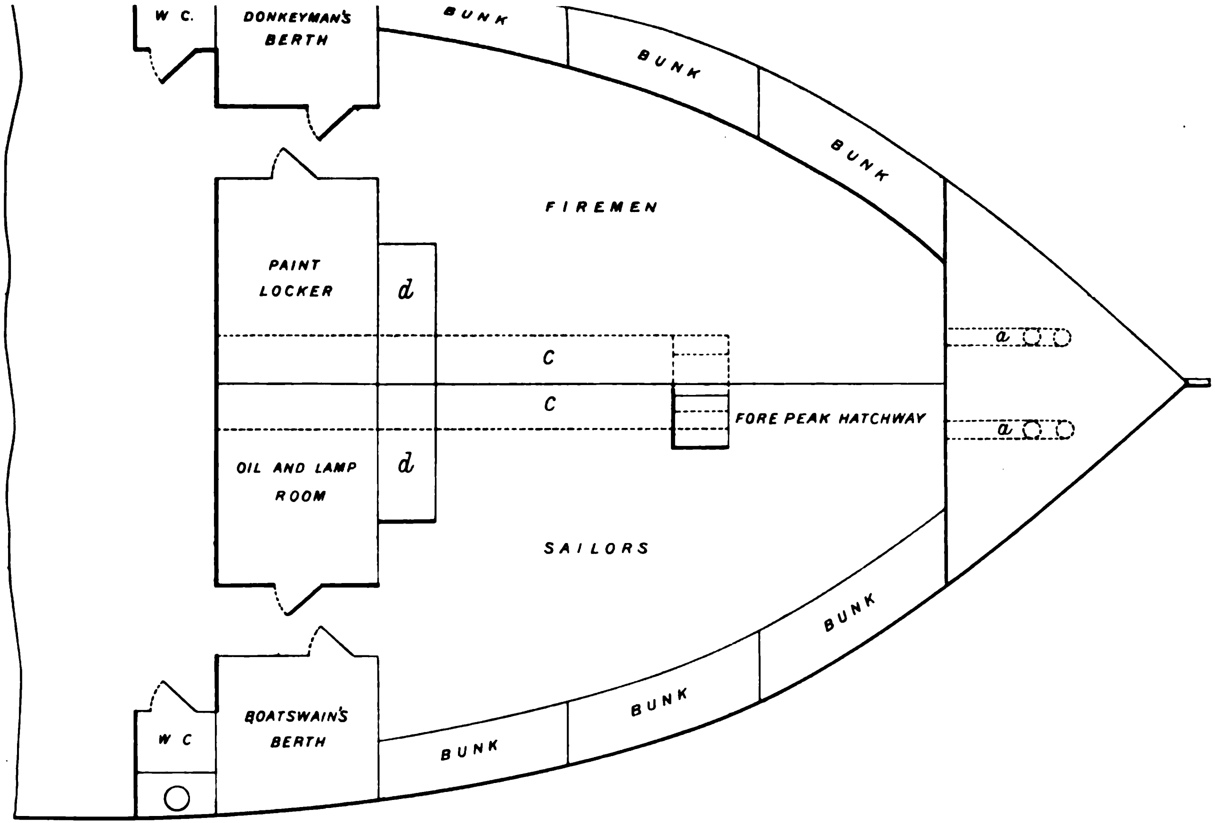
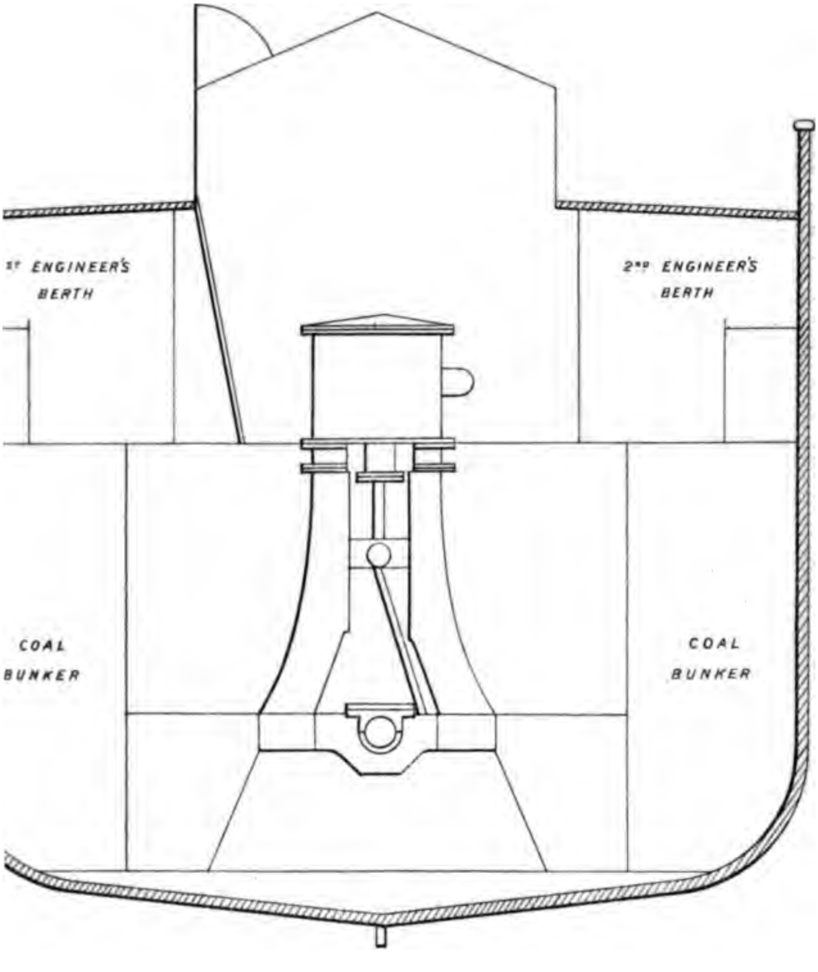


FIG. 11. PLAN OF TOPGALLANT FORECASTLE.



2. SECTION AT ENGINE ROOM SHOWING BERTHS AT SIDES OF CYLINDERS.
(LOOKING FORWARD)

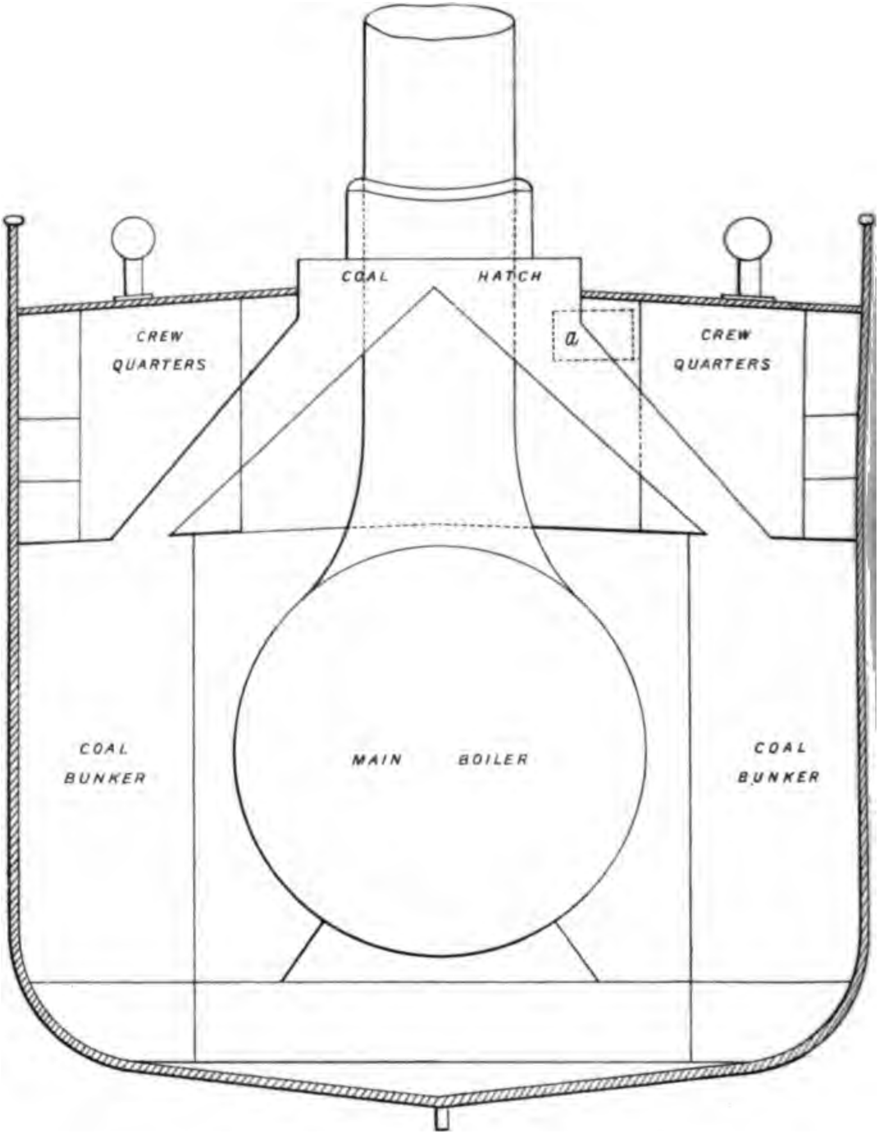


FIG. 13. SECTION SHOWING CREW QUARTERS OVER BOILER.
(LOOKING FORWARD.)

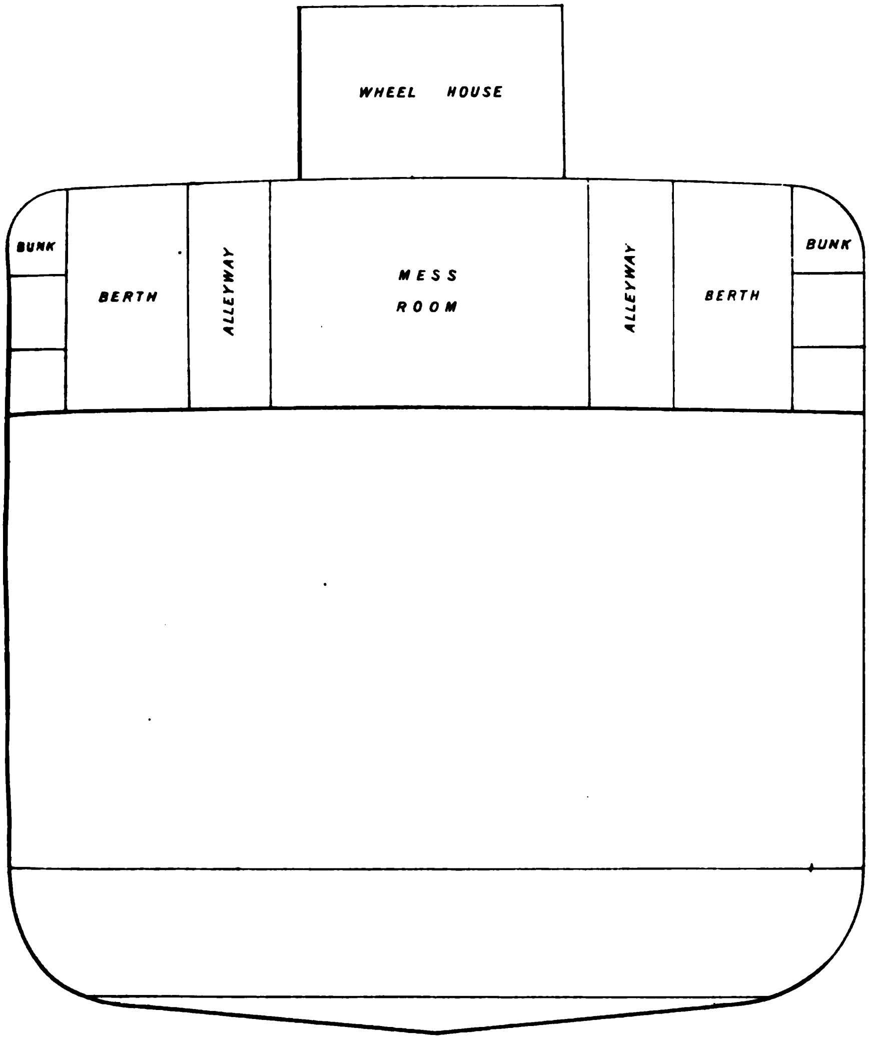


FIG. 16. TRANSVERSE SECTION AT A. B.
(LOOKING AFT.)

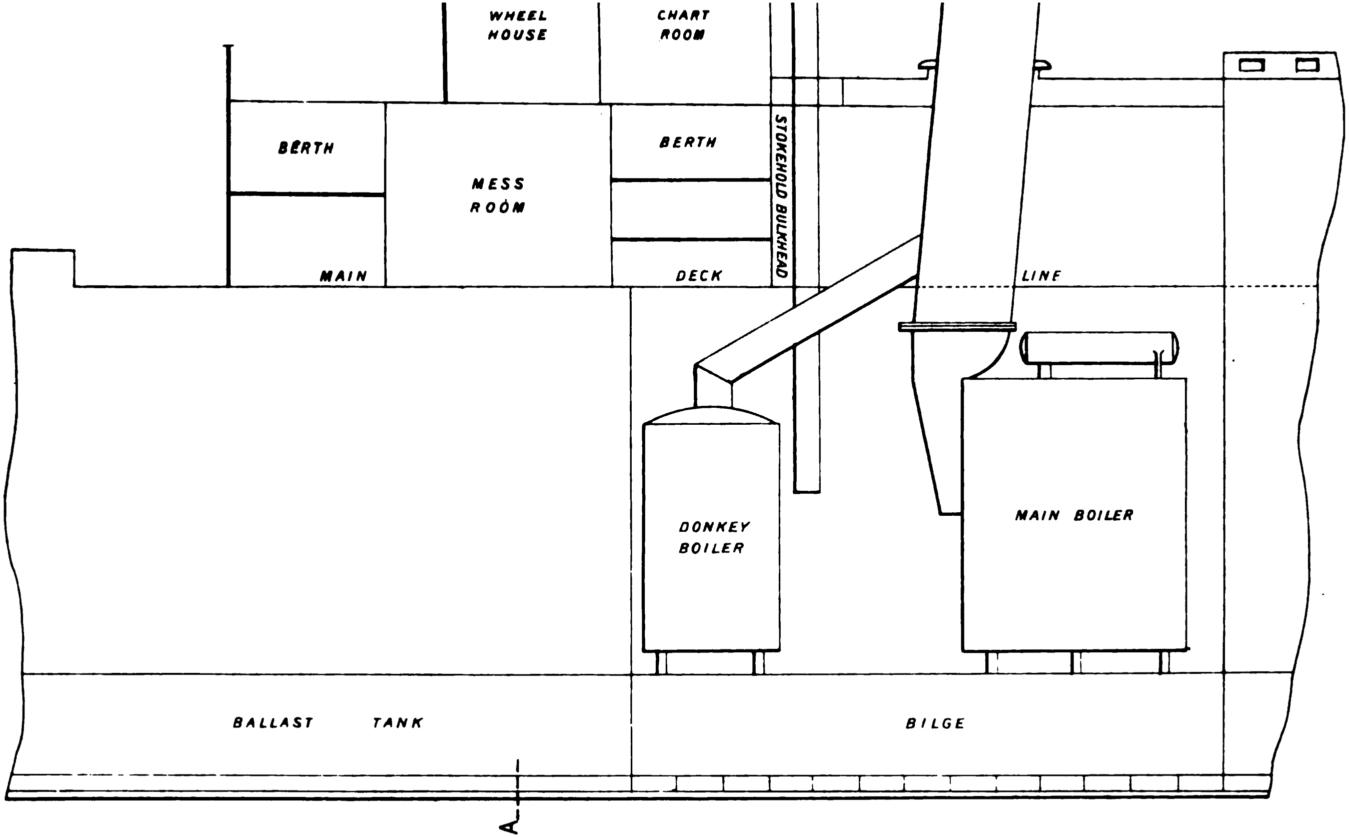


FIG. 15. SECTION SHOWING BERTHS OVER DONKEY BOILER.

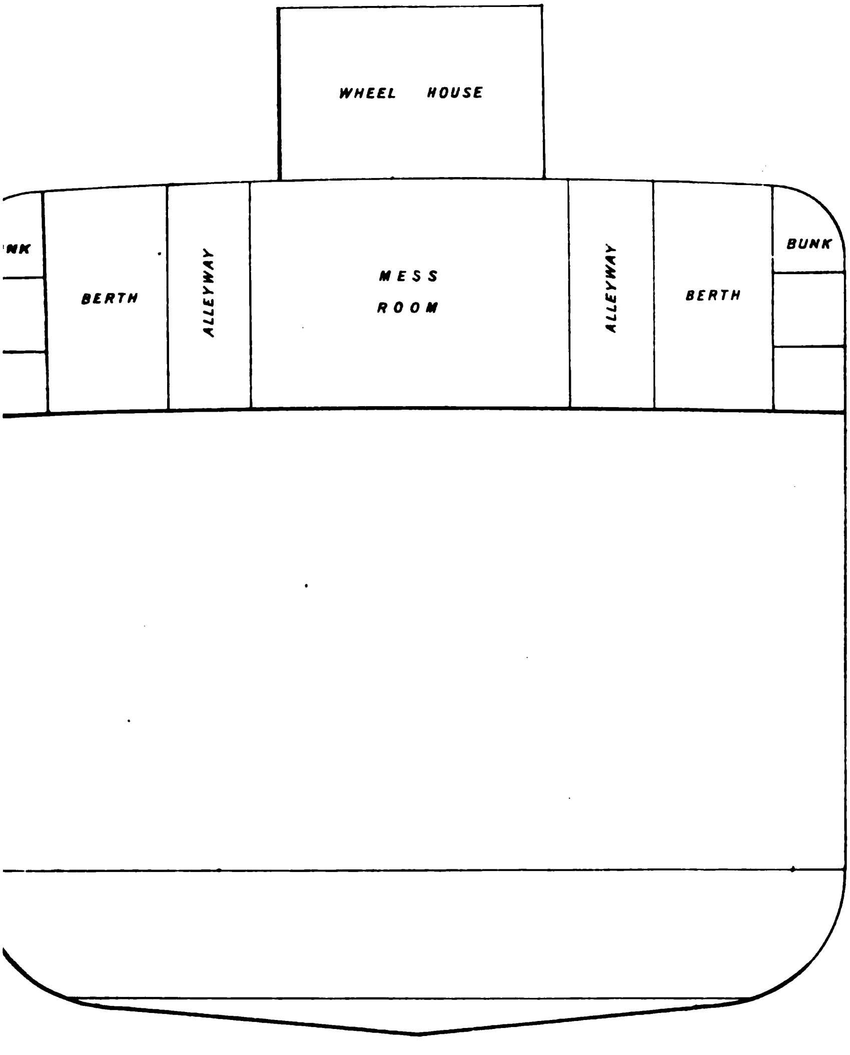


FIG. 16. TRANSVERSE SECTION AT A. B.
(LOOKING AFT.)

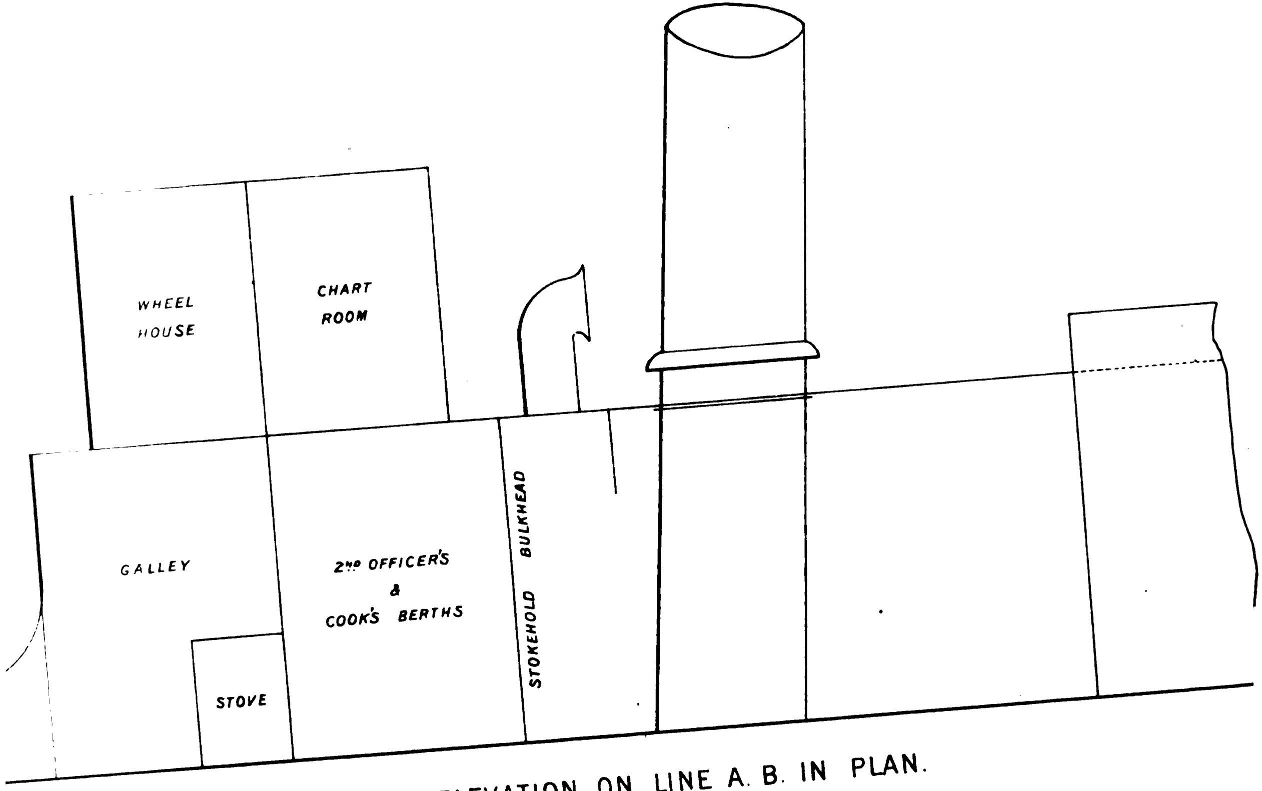


FIG. 19. SECTION ELEVATION ON LINE A. B. IN PLAN.

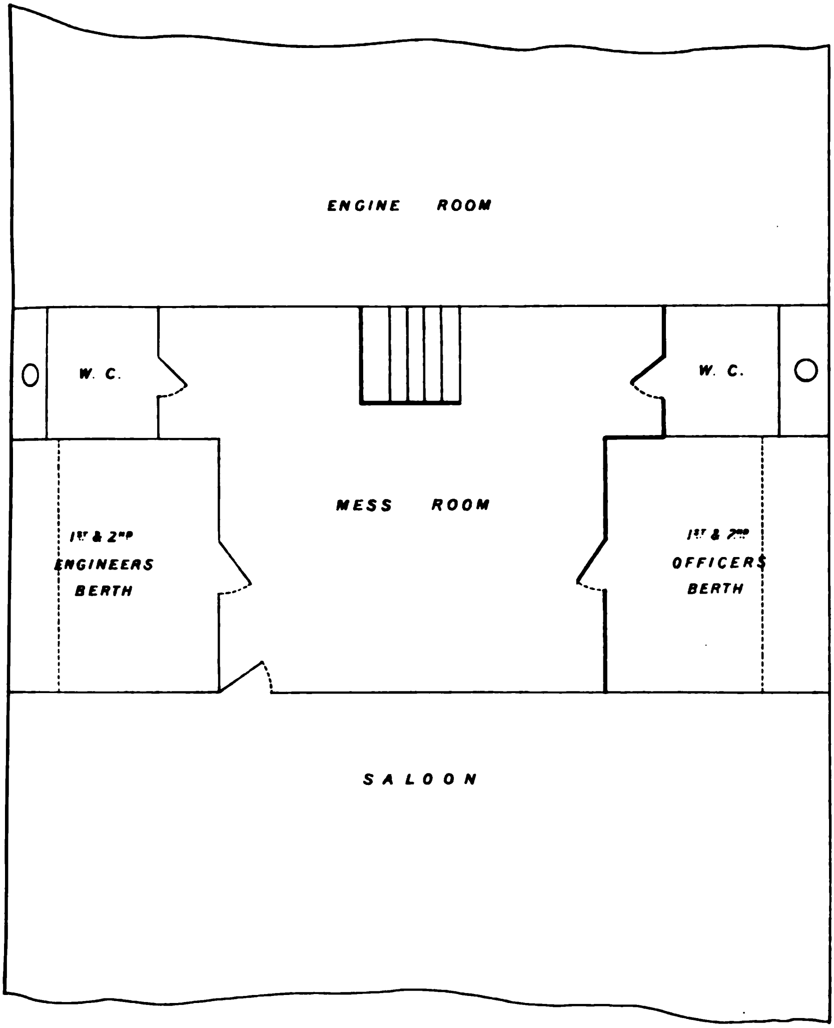


FIG. 20. PLAN SHOWING ARRANGEMENTS OF BERTHS, MESS ROOM & CLOSETS BELOW THE MAIN DECK.

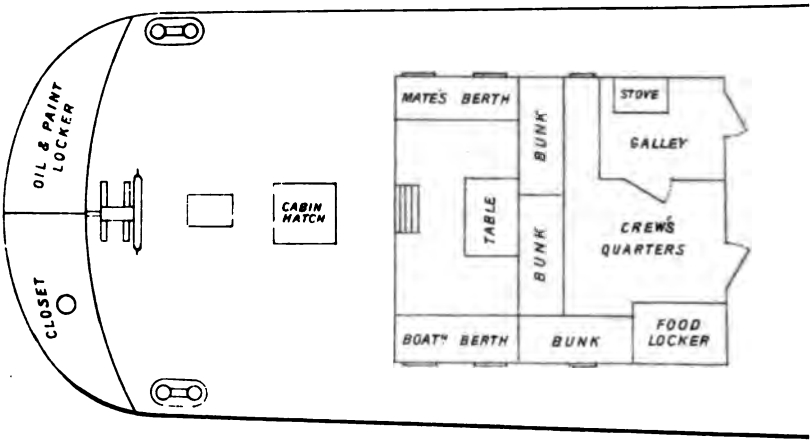


FIG 21. PLAN OF DECK-HOUSE OF GERMAN SCHOONER.

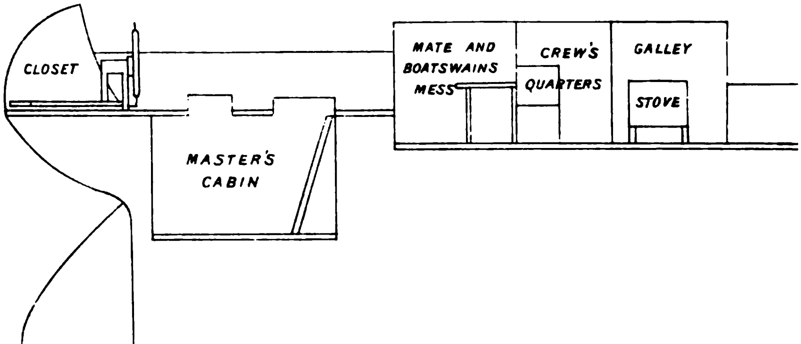


FIG 22. SECTION SHOWING ARRANGEMENT OF DECK-HOUSE OF A GERMAN SCHOONER (WOOD).

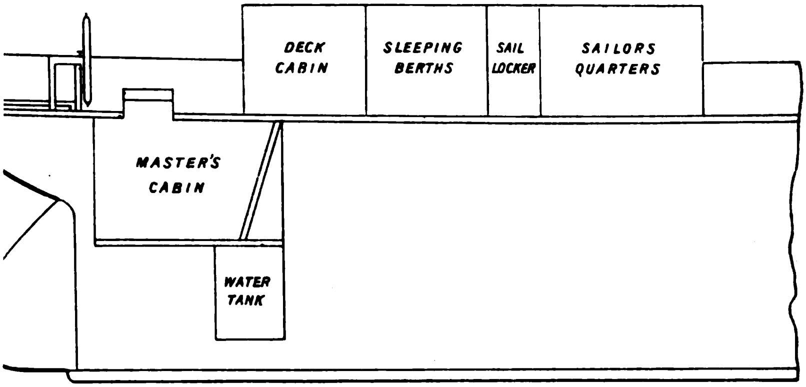


FIG 23. SECTION SHOWING ARRANGEMENT OF DECK-HOUSE OF A DUTCH BARGE (IRON).

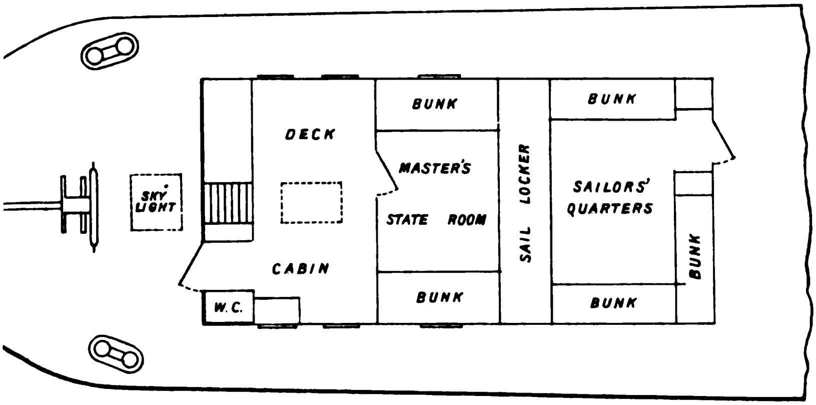
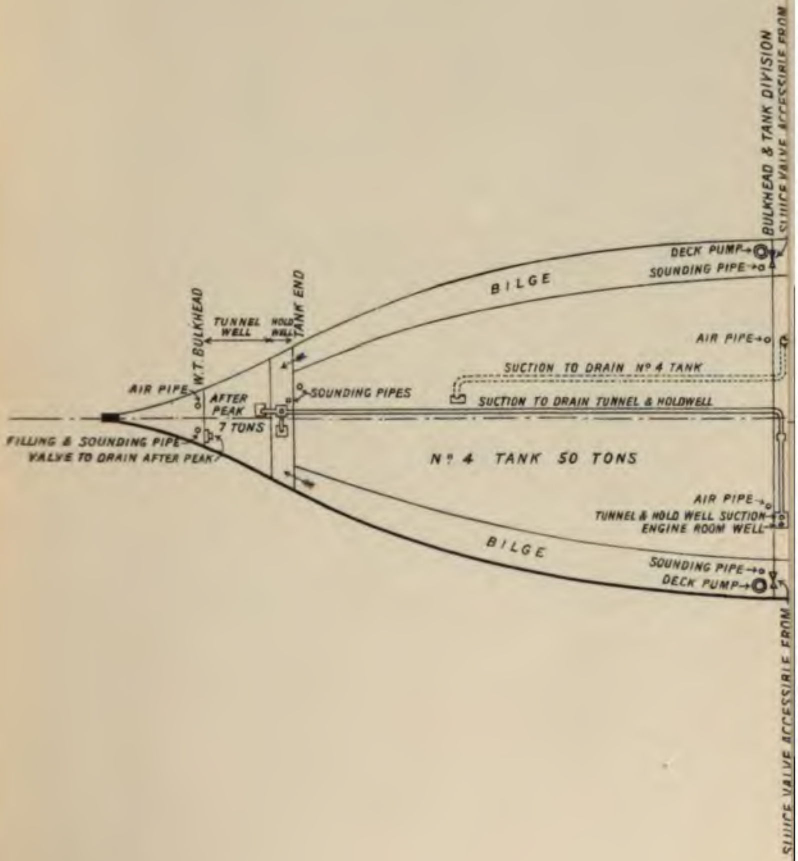
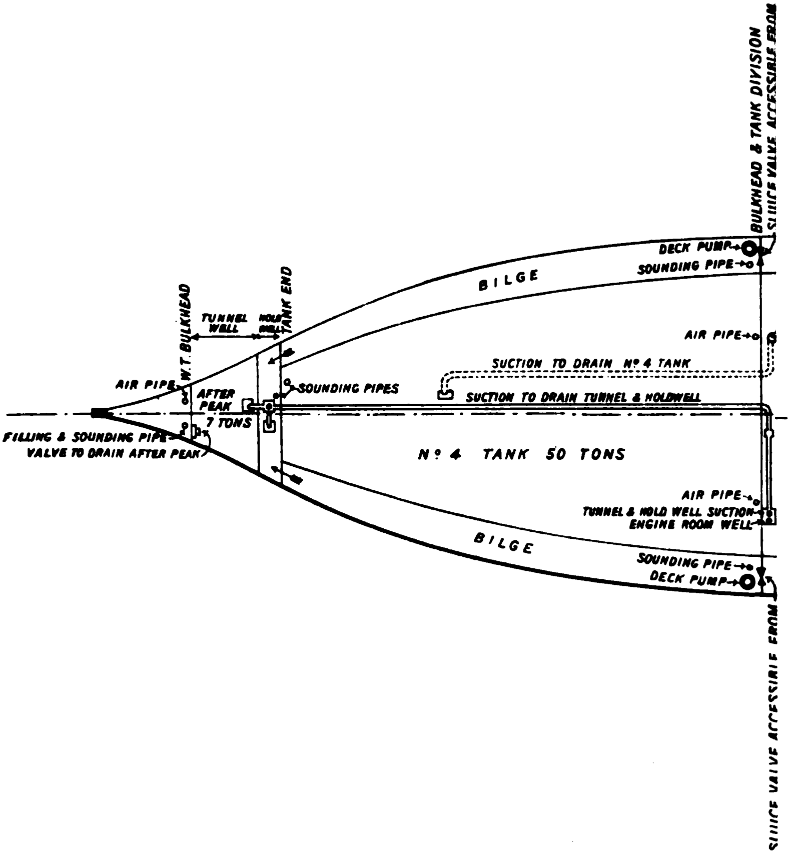


FIG 24. PLAN OF DECK-HOUSE OF DUTCH BARGE.


W.T. BULKHEAD
TUNNEL WELL
HOLD WELL
TANK END
BILGE
DECK PUMP
SOUNDING PIPE
BULKHEAD & TANK DIVISION
SLUICE VALVE ACCESSIBLE FROM
AIR PIPE
SUCTION TO DRAIN Nº 4 TANK
SOUNDING PIPES
SUCTION TO DRAIN TUNNEL & HOLDWELL
AFTER PEAK
7 TONS
FILLING & SOUNDING PIPE
VALVE TO DRAIN AFTER PEAK
Nº 4 TANK 50 TONS
AIR PIPE
TUNNEL & HOLD WELL SUCTION
ENGINE ROOM WELL
BILGE
SOUNDING PIPE
DECK PUMP
SLUICE VALVE ACCESSIBLE FROM

FI


W.T. BULKHEAD
TUNNEL WELL
HOLD WELL
TANK END
AIR PIPE
AFTER PEAK
7 TONS
FILLING & SOUNDING PIPE
VALVE TO DRAIN AFTER PEAK
SOUNDING PIPES
BILGE
DECK PUMP
SOUNDING PIPE
AIR PIPE
SUCTION TO DRAIN Nº 4 TANK
SUCTION TO DRAIN TUNNEL & HOLDWELL
Nº 4 TANK 50 TONS
AIR PIPE
TUNNEL & HOLD WELL SUCTION
ENGINE ROOM WELL
BILGE
SOUNDING PIPE
DECK PUMP
BULKHEAD & TANK DIVISION
SLUICE VALVE ACCESSIBLE FROM
SLUICE VALVE ACCESSIBLE FROM

F1

In either of these rooms there is a port-hole in the bulkhead, no doubt originally meant for lighting and ventilating purposes. There is also in each room a square window which opens into alleyways (*c*), the lower part of which being level with the top bunk, would, when opened, expose the occupant to a draught. Opposite to this window on the other side of the passage, at a distance of about 4 ft., is the closet.

Fig. 16 shows the berths with the bunks at the side of the vessel under the half round, a position open to many objections, primarily owing to the fact that in high and low latitudes they are found to be either abnormally cold or hot, as the case may be. The retentive properties of iron as regards cold or heat is not sufficiently taken into account, and the usual wooden lining is no barrier; still the remedy will not so much depend on non-conductors as on the position. By having the bunks fitted against or near to the fore and aft bulkhead, instead of at the side, a more equable temperature at all times will be ensured. Again, side-ports, so commonly relied upon for ventilating purposes, will, if these means be adopted, be of more practical use, as the need for closing them will in a great measure have been removed.

As regards ventilation. If a continual current of air could be maintained through the alleyway, to carry off the heated and sulphurous air from engine-room and stokehold, no better system of ventilating berths by admitting air from the alleyways could be adopted, as the need for closing ventilators would not arise; but unfortunately it is not so, for the direction of the wind will more often cause interruption, and also when cargo and bunker coal is carried there. Consequently this system is to be deprecated under all circumstances.

Fig. 17 is a plan showing living-rooms adjacent to engine-hatch, below the half bridge deck, and in the immediate surroundings of engine-room, with doors leading thereto. These quarters are in no way protected from the heat transmitted from the engine-room and the iron deck overhead;* consequently in temperate climates in the summer months these rooms are abnormally hot, and at times unbearable.

The defects indicated are of course intensified in vessels trading in hot climates, as no through draught can be obtained to carry off the hot air, so that sleeping and taking meals on deck are resorted to.

Fig. 18 is a plan of the main deck showing arrangements of berths below the bridge deck (see section elevation, Fig. 19). Access to these places is by a scuttle hatch on the starboard side of the bridge deck, and from a door leading from the stokehold. It will be seen that the 2nd officer and cook's berths are situated between the galley and the stokehold bulkhead. It is obvious that these berths are practically useless, as no amount of sanitation will render them habitable under the circumstances, and yet these rooms are recognised as crew spaces by the Board of Trade. This vessel has been in the China trade for a number of years.

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* In the 1895 Instructions to Surveyors, it states in paragraph 45 (iron decks): "In any case in which there is an iron deck over any space for which deduction is claimed as crew space, the iron deck must be sheathed with wood on upper side, securely fastened and caulked. The wood deck need not in any case exceed 2½ inches in thickness. If there are iron bollards or other fittings preventing the complete sheathing of the deck, the Surveyor is to see that no portion of a sleeping bunk is placed immediately under them." This paragraph, for reasons best known to the Board of Trade, is not enforced.

Fig. 20 illustrates the position of officers' and engineers' berths and mess room below the main deck adjoining the engine-room bulkhead. It also shows a closet on either side abutting on to the berths, with doors opening into mess room. This without a doubt is very objectionable, as the average crew closet below deck is a nuisance.

DECK HOUSES.

Now comes the question to what degree of health man may hope to attain, having regard to existing circumstances and customs, and without heavy expenditure, in other words, without building castles in the air, or seeking to inhabit balloons, as he would require to do to become as healthy as the birds. This condition is therefore unattainable: and here as everywhere, to demand perfection leads to realizing little or nothing.*

Yet perfection should always be the direction aimed at by human efforts, however imperfect may be the result: and the success of Sanitary legislation will be measured by the nearness or the distance of its actual results from the perfect idea. This is the spirit in which the Public Health Acts of this country have been enacted from time to time for the good of the people and the country generally. To Sanitary Scientists much is due for their untiring energy in this direction, but however much they have advanced the science of how to live healthily, their efforts in the main have been devoted to the laws which govern the elements on shore: and although the same natural laws will apply to vessels afloat, still the construction of a ship differs so much from that of a house, that to obtain a like degree of success, a greater attention to this subject is needed.

Now the point is, what is *l'objet désiré* in crews' quarters. The upper or top-gallant forecastle is a decided improvement on the lower forecastle, still it leaves much to be desired. In steamers, the alleyways do not offer sufficient facilities for maintaining a habitable condition under all circumstances. But with deck houses the case is different. Situated above the main deck, constructed as a rule mainly of wood, with good ventilation and proper lighting made easy, are conditions which should be taken greater advantage of. Deck houses possess even greater facilities for ventilation than houses on shore, and this is one of the principal objects aimed at.

The following deck house illustrations are for the purpose of showing how the insanitary lower forecastle difficulty may be overcome.

Figs. 21 and 22 represent the plan and section of the crew arrangements on a German schooner of about 150 tons employed in the coasting trade. This method of location is also common to Dutch vessels. On all the important rivers of Germany and Holland this custom prevails.

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* Dr. Jaeger on "Health Culture."

The after cabin below deck is exclusively the master's. The mate and boatswain are located in the after part of the deck house, which place is likewise fitted as a mess room, where, together with the master, they take their meals. On the forepart adjoining this place will be found the sailors' quarters and galley. The bunks, it will be seen, run athwartships as well as fore and aft, and are conspicuous by their box-like shape against the divisional bulkhead and side of the house. Access to each bunk is by a narrow entrance fitted with a slide. This is the one great fault which attaches to these sleeping berths, because in the winter months the men will close these apertures; and if it were not for the defective lining and ill-fitting bottom boards, the consequences would probably more often be fatal.

The disadvantage of having the galley so near the crew spaces is that, in addition to the heat it generates, it attracts all sorts of insect life, and assists in a great measure to foster vermin so prevalent in places where there is much wood lining.

Having a raised deck aft above the master's cabin, enables the officers on watch and the helmsman to have a clear view of the ship's head and the forepart of the vessel.

Light and ventilation is by skylights and side ports.

Figs. 23 and 24 are section and plan of the crew arrangements on a Dutch sailing barge employed in the coasting trade, which may be called a family ship, and is typical of the many of this class found on all the large rivers of the Continent. For comfort and cleanliness, it must be admitted they surpass anything to be seen afloat. Every available space is chosen to advantage, and "a place for everything, and everything in its place," appears to be the order of the day.

The deck cabin has a skylight and four square ports at the sides, which are protected in bad weather by iron shutters. Cupboards and food lockers come in for particular care; in the case of the latter they are not to be found in living spaces. The good "frau" has no need to go on deck for water, as by a very suitable and simple contrivance she can either pump the water from over the side or from the fresh-water tank. The sleeping berth is also well lighted and ventilated.

The sail lockers between the cabin and sailors' quarters form a good division.

In Scandinavian vessels all crew spaces are above the main deck; the master's and mates' being located in a separate deck house to that of the sailors; both places being well lighted and ventilated. But the bunks are found to be in all cases extravagantly wooded, and the lower bunks raised but a few inches from the floor.

As to the design and internal fittings of deck houses in general, a great deal will depend on position and space. When convenient, have iron frames for bunks, and use as little wood about them as possible. Food and oilskin lockers to be near the door, or apart altogether.

BILGES.*

Bilges have in some instances been compared to the drains of a house, this is erroneous as in no sense can they be so compared, the former are primarily a necessity for the safety of the ship, whilst the drain of a house is a channel by which means all fœcal and other matter is conveyed which on shipboard goes direct over the side, thus the functions of the one are different to that of the other. The comparison is misleading and the word "drain" a misnomer as far as a vessel is concerned.

The word "bilge" is derived from the German meaning a bulge or protuberance. If we look at a vessel end on, we see that the sides at the part indicated bulge or project.

Roughly speaking the bilge of a ship is a channel or water course covering the whole breadth of the vessel's bottom, between the frames, and the outer skin and ceiling, Fig. I. (A) (*a*) (*a*).

In vessels that have a double bottom or water ballast tank, Fig. 2 (A), the space (*b*) (*b*) at the bilge forms a gutter way at the sides. In either case it will receive leakage from any part of the vessel below the main deck line, drainage from cargo, and water which is the result of the condensation common to all iron vessels.

Fig. 1 (A).

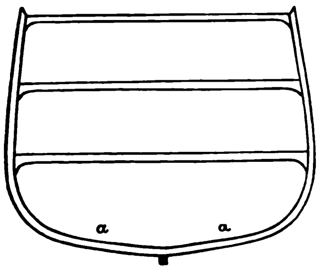
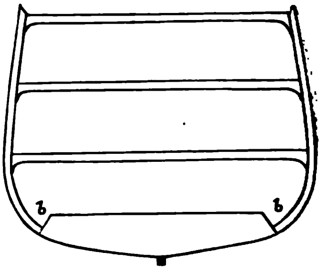


Fig. 2 (A).



"Gutter" bilges offer greater facilities for cleansing purposes than other types, as access is easier to all parts, and they are therefore not so likely to become neglected. Unless, however, there is a tight ceiling dirt will accumulate on the tank top, and may give rise to a serious nuisance.

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* BILGE.—That part of the floor of a ship upon which she would rest if aground; being that part near the keel which is more in a horizontal than a perpendicular line.—Dana's "Seaman's Manual."

The term "bilge" (derived from bulge) is applied by shipbuilders to this part, and by sailors to the cavity in which offensive liquid known as bilge-water collects.—"Marine Hygiene," by Dr. Armstrong.

To ply the pump, and no means slack
May clear her bilge, and keep from wrack.
Olia Sacra (1648), p. 162.

In emigrant vessels fitting-out, the first care of the Surveyor is to inspect the bilges in order to see they are clean, thus clearly demonstrating that the importance of this is recognised. Unfortunately a stagnant bilge soon becomes foul, and no provision is made to cut off effluvium conveyed by scupper pipes.

In living quarters below the main deck there is always a danger of the air becoming polluted by a foul bilge. Reference has already been made in "lower forecastles," "engine rooms," and "stokeholds," to the various sources of pollution.

Dr. Collingridge, Medical Officer of Health for the Port of London, states in his "Practical Points on the Hygiene of Ships," read before the Shipmasters' Society: "The first point for consideration in the health of a ship should be her bilges. Into these there is a constant passage of water containing putrescible organic matter, which, collecting and becoming mixed with a certain amount of salt water, rapidly decomposes, and tends to seriously affect the health ot all on board. Not only have these products of decomposition a generally unhealthy effect, but there is no doubt as to the conveyance of certain diseases, especially cholera, yellow fever, and malarial fevers."

Fig. 25 is a plan showing the bilges at the sides of the water-ballast tanks, and also the pumping arrangements for both bilges and tanks.

Besides the mechanical means for emptying the bilges from the engine room, the diagram shows the position of the sounding pipes and the hand-deck pumps.

The position of the air and sounding pipes of the ballast and peak tanks are likewise shown. The ballast tanks are filled at (*a*) on the port side, and are emptied by the same filling pipe connected with the donkey pump, the valve at the vessel's side being closed for the time being. Therefore, it will be seen that the bilges and tanks are under the immediate control of the engine-room staff.

The ship's carpenter plays an important rôle as far as these matters go, because upon him lies the responsibility of ascertaining and reporting a true record of the soundings of all wells, tanks, and bilges at frequent intervals during the day, but in most vessels at 8 a.m. and 8 p.m., a record of which is kept on a "soundings" board usually found at the top of the engine-room ladder, which the engineer going on watch cannot fail to see; besides this, the carpenter reports to the officer on watch, who in turn makes a note of it in the day log.

The position of air and sounding pipes in living spaces is a matter of serious moment from a hygienic point of view. As the caps of these pipes have to be taken off when the filling and emptying of the tanks takes place, it can be well understood that the air in such places is open to pollution from the foul gases generated in an empty tank, and from polluted water. Another question arises, in so far as this is concerned, namely, the expense in time and money which attaches to the regular cleansing of these honeycombed structures in the bottom of the vessel, hence it is obvious the cleansing will sometimes be shirked, thus aggravating matters which could be remedied by having such connections anywhere but in living spaces.

It is within the writer's recollection that a complaint was made to him by one of the crew berthed in the alley-way as to a smell arising from an ill-fitting cap, the ballast tank having been filled at a port where the water was stagnant and sometimes putrid.

Water as Supplied to Vessels in Foreign Ports.

We now come to another important point—the supply of good water. At all times and in all countries and climates, its possession has been looked upon as one of the great blessings—its absence as a great curse.

In the maritime life of the world this statement fitly applies, as there is no other calling which has suffered so much from its effects. From time immemorial, we have heard of the sailor's "pound and pint," and many instances have given us food for reflection on reading of a vessel arriving in port with scurvy on board, short of provisions, and short of water. These instances fortunately are few and far between at the present time, vessels are better equipped, due no doubt to improved education and the stringent measures adopted by the Board of Trade in promoting a wholesome supply of provisions and water, a result proving beyond question how wise and useful these have been, still the measures adopted do not cover the whole question of the water supply, as they only ensure clean tanks and good water at a home port, of which, unlike provisions, a sufficient quantity cannot be carried for the round voyage, consequently the responsibility still rests with the shipmasters of safeguarding as far as lies in their power, the health of the crew under their charge. Unfortunately it is a subject to which they have given too little heed, and knowing that bad water means a sick crew, it is surprising no action has been taken on their part in reporting on some of the ports where sickness has been traced to this cause.

It must be borne in mind that on shore the quantity of water the average man will drink varies considerably, depending mostly on the season of the year and the nature of his work. The same, to a greater extent, will apply at sea, where the only beverage is water, and where the climatic changes are more frequent. With those employed in engine-room and stoke-hole departments, the quantity that is drunk by the staff in hot climates, when the vessel is under steam, is enormous, varying in quantity from one to one and a half gallons or more per man for four hours. Is it then surprising that the engineering staff feel the first ill effects of impure water? No wonder diarrhœa is so prevalent in these departments.

Dr. Armstrong, in referring to the contamination of drinking water in his able work "Marine Hygiene," states: "M. le Fevre has demonstrated beyond dispute that 'colique vegetale' was nothing more nor less than lead poisoning, due chiefly to impregnation of the drinking water with that metal from the tubes of a distilling apparatus then in the use of the French navy, the solder of joints in connection with the feeders of water tanks, &c. The large amount of water consumed by stokers at once accounted for the great prevalence of the disease among this class."

Certain ports in the Mediterranean are noted both for the indifferent quality, and the method of taking water off to vessels. Gibraltar ranks first; the ordinary tramp steamer avoids as far as possible taking water here on this account, the water supplied to vessels having the reputation of being brackish, and the antiquated method of taking water off in the casks is still resorted to.

Drinking water supplied to vessels at Constantinople comes principally from Bëresk on the Bosphorus and also in smaller quantities from the supplies of the Scutari Water Company. The water boats employed in this service are of wood and no supervision is exercised over them by Port Authorities, with the exception of their being numbered and registered. The water may be pure but what will this avail, if these wooden water boats which have been working for years are not under strict supervision to ensure periodical cleansing and repairing. Again the keen competition that goes on in this place is hardly consistent with the object of obtaining a wholesome supply.

Ports situated on the delta of the Nile are mostly dependent on Nile waters. Alexandria is noted for its bad supply. Traders avoid as far as possible filling up here, and when they do, this water is mainly used for cooking and washing purposes. Can it be that the water boats are not properly looked after? This should be of particular interest, seeing that cholera is at the present time raging in the neighbourhood.

An instance which came under the personal observation of the writer will perhaps be of interest as regards Port Said, which is also supplied with water from the same source.

When chief officer of a certain steamer, my vessel was discharging, together with another steamer, at Port Said, from whence we both proceeded to Batoum. We did not water at the former place owing to one of the Port doctors informing us (on enquiry) that the water was full of organic matter, in consequence of the Nile being low, in lieu thereof we condensed a sufficient quantity to take us to Constantinople; the other steamer not taking the same precautions, received her supply at Port Said and on arrival at Batoum, half the crew were down with diarrhœa and dysentery.

The supply at Port Said has greatly improved within the last two or three years, that is since filter beds have been introduced. Iron water boats are used for conveying water to the vessels, but do they come in for strict supervision by the Port Authorities?

Malta water is good by repute, and the water boats come in for particular observation.

Marseilles water is not always to be relied upon, whether it is for the want of supervision of the water boats remains doubtful, however an instance which came under the writer's personal experience is worthy of note.

When chief officer of a steamer bound from Marseilles to the Black Sea, we took our supply from the former place, and two days after sailing we were all suffering from diarrhœa. It began first with the firemen, one being laid up who was eventually landed at Constantinople suffering from dysentery. We shipped another in his place, who was laid up the next day with all the symptoms of cholera, and on arrival at Nicolaiev he was taken on shore to hospital.

The water was stored in two tanks, and on arrival at Constantinople, one was emptied and filled with water from there, the other tank with Marseilles water was reserved for washing purposes, and it was this water the new fireman inadvertently drank. On our return journey we filled up our supply at the mouth of the Kherson River for the use of the crew, at the same time condensing for live stock.

There are many other ports in the Mediterranean where not so much the quality of the water is impugned but the water boats used for storage purposes.

Aden : the supply is condensed water, and is conveyed to vessels in large iron tanks.

Colombo : supply good, boats looked after.

Point-de-Galle : water good, but owing to the little trade done here as a coaling station, the water will be often stored for long periods of time in old wooden water boats.

Singapore : water good, and supplied to vessels direct from the Tangon Pagar Wharf.

RIVER WATER.

River water too often finds its way to the fresh-water tank—derived, as it mainly is, from springs, it is composed largely of surface rain water contaminated with impurities received along its banks; therefore, in malarial countries it will contain much deleterious matter, and should at all times be avoided for drinking purposes unless distilled before use.

In a general way it may be taken that drinking water drawn from rivers is dangerous—more especially that from the deltas of rivers within the tropics.

On certain rivers it has become quite a custom to seek the pilot's advice as to the best time and place for filling the tanks; this practice prevails notably at the River Plate, Amazon, Mississippi, and the Danube. In the East, the waters of the Hooghly, Bassein, Rangoon,* and other rivers have had their share in giving the old

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* DRINKING IMPURE WATER.—At an inquest held on the 7th inst., at Portsmouth, on the body of Captain Sorren A. Gundersen, of the Norwegian ship Enterprise, of Tunsberg, who died when off the Scilly Islands, it was proved that his death was caused by parasites conveyed in the water which had been served out on board. The water was taken in from a water boat at Rangoon. Two of the crew succumbed previously, after showing similar symptoms to those experienced by the captain, and were buried at sea. Fresh water was taken in at St. Helena, but did not produce much change. It transpired that the water was not boiled before drinking.—*Gravesend Reporter*, 12th May, 1894.

"shell back" endless direful tales to hand down to posterity. Nearer home, and at the Black Sea ports, matters do not improve, as this custom is still in vogue. The Danube water is at the present time coming in for a certain amount of exposure by crews of vessels.

From the official report on cholera at Buda Pesth, by Professor Ludwig Gebbart, it appears that the use of Danube water was regarded to have been the chief factor in causing the spread of the disease in that city, it being stated that cholera attacked for the most part such persons as had drunk Danube water, whether filtered or unfiltered, whilst, on the other hand, those who had obtained their water supply from springs, or who had boiled the water obtained from the public supply, generally enjoyed immunity. The level of the ground water and the circumstances of the soil were not considered as having exercised any influence.*

Most of the Baltic ports are likewise famed for their unreliable water supply, and the majority of vessels trading there during the summer months endeavour as far as possible to make their drinking water last the voyage, using the water obtained at any of these ports for cooking and washing purposes only. Unfortunately very many vessels are unable to do this owing to the limited capacity of their tanks.

In referring to the part played by water in the diffusion of cholera at St. Petersburg, Dr. F. W. Barry in the report, previously quoted, states:—

"It was found that the earliest cases were confined to the workmen in the large factories situated on the banks of that branch of the Neva known as the Great Nevka. The workmen were accustomed to drink water derived directly, without filtration or boiling from this branch of the river-water, which at all times is charged with much organic matter (14 parts in 100,000), and which produces gastro-intestinal catarrh in all persons unaccustomed to its use. It was at once arranged that water should be supplied to the workmen from the town waterworks, and that this water should be filtered or boiled before drinking. The effect of the change in the water supply was immediate, and there was no further spread of cholera in that part of the city."

The custom, however, is not confined to the workmen in the factories alone, but to all those employed on the river craft; it is a practice that has lent itself to vessels trading there, as the supply till very recently was taken direct from the river.

A consular report on the district of Riga (Foreign Office 1894, No. 1337) contains the following particulars:—

"The last choleraic attack at Riga was in November from 12th to 24th. In all there were 53 cases of which 21 proved fatal; the number last year being 151 and 75 respectively."

The character of the disease was not of such a malignant type as last year: it made its appearance a month later and only lasted 39 days. The persons attacked were mostly from the same localities and of the same classes as those last year; viz., *the labourers at the port, and on board ships, and men engaged on the river, who regardless of the notice published by the Sanitary Authorities prefer to drink unboiled river water.*

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* Report on the Origin and Progress of the Western Diffusion of Cholera during the year 1892, by Dr. F. W. Barry. Twenty-second Annual Report of the Local Government Board, 1892-3.

In the face of such facts it is obvious that a great responsibility rests with the shipmaster, and the time has arrived when he should be assisted in such a way as would relieve him of the constant worry and expense, due more often to sickness, he is subjected to in this water business.

Could not some ports be fixed where a pure and wholesome water supply could be relied upon? Take for instance all the coaling stations, it would only entail a little strict organisation to ensure this, shipmasters are oftentimes handicapped at these ports, because to refuse water of a doubtful nature would sometimes mean many hours of detention and a consequent loss to his owner, so that as a rule he takes what he can get.

But until strict supervision is exercised by Port Authorities, it would, in all cases, be better to condense instead of filling up with doubtful water.

On the question of condensing for supply there is not at all times perfect unanimity of opinion between the shipmaster and engineer.

The view that the engineers take is in the direction of increase of deposit in the boilers, and the greater consumption of coal which condensing necessitates.

An instance bearing on this subject will perhaps be of interest.

On a certain vessel bound to a cholera-stricken port, the master instructed the chief engineer verbally to condense for supply to save taking in water at that port. The engineer demurred and stated that the condenser was out of repair, and could not be used. On this the master gave him written instructions to start without delay, at the same time stating that a copy had been inserted in the log. It is needless to say the order was executed well within the specified time, with the result that no water was taken in at the infected port and no sickness occurred on board.

FREE AIR SPACES.

Before any definite idea as to space allowance can be arrived at, the most important point bearing on the question of cubic space on board ship, is to know in what manner crew-quarters are occupied, and also the nature of the duties of the different classes of men. For this purpose it will be necessary to class the various grades, taking them in rotation, viz.:—

(1). Officers.
(2). Engineers.
(3). Petty Officers.
(4). Stewards and Cooks.
(5). Sailors.
(6). Firemen and Trimmers.
(7). Lascars „ „
(8). „ (Deck).

(1). *Officers*—In crowded waters and particularly this side of Gibraltar or Port Said, the practice on board many steamers, is for the officers to keep "watch-and-watch," usually kept by the 1st and 4th officers together in the one watch, and by the 2nd and 3rd officers in the other. Then as occasion requires it, the watches are split up into "three watches" kept respectively by the 1st, 2nd, and 3rd officers, the 4th officer being on all day and relieving for meals.

In port, unless the vessel is lying at single anchor, no watch is kept, and officers are on duty all day.

The 1st and 2nd officers have each their separate berth, the 3rd and 4th as a rule being lodged together.

In the coasting trade the two officers keep "watch-and-watch," and in a great many instances live together in one berth.

(2). *Engineers.*—The watches, as in the officers' case, will depend on the number of engineers carried on each vessel. When there are three it may be taken for granted that the "three watches" are adhered to.

In port, unless under banked fires, no watch is kept, and engineers are on duty all day.

The 1st and 2nd each have separate rooms, the 3rd and 4th as a rule occupy the same room.

(3). *Petty Officers.*—Include boatswain, carpenter, donkeyman, and quartermaster. The two former live together, whilst the donkeyman in most cases has a separate berth, but sometimes lives with the firemen.

These men are on duty all day. Quartermasters, when space permits, live by themselves, otherwise they are located with the sailors. They keep "watch-and-watch" at sea, their duty being to steer the ship and keep the time.

(4). *Stewards and Cooks.*—On duty during the day, and are usually located together.

(5). *Sailors.*—Sailors keep "watch-and-watch" at sea, *but not in port*, when the hours of duty are from 6 a.m. to 6 p.m., with intervals for meals; one man being told off to act as night watchman. These men live together.

(6). *Firemen and Trimmers.*—Keep three watches when the vessel is under steam. *No watch is kept in port.* Their duties are from 7 a.m. to 5 p.m.

(7). *Lascar Firemen.*—With Lascar firemen the routine differs but slightly from that of their European *confrères.* They have their separate quarters.

(8). *Lascars* (*Deck*).—Keep what is termed a "Coolassie watch," which is really no watch at all. At sea or in port they must be ready to turn out at any time. This rule, however, is diversified in some vessels by the fact of perhaps three "pooree wallahs," or watchmen, being on duty at night time.

It will thus be seen that officers and engineers cannot much complain as to the apportionment of berths. Still, it is to small cabins, and such as are occupied by stewards, cooks, quartermasters, and sometimes sailors and firemen, that the question of over-crowding will mostly apply, and also to the larger quarters occupied by sailors and firemen in passenger vessels.

An idea which has given rise to much discussion and which has been used as an argument against increased cubical allowance, is that sailors and firemen always keep "watch-and-watch," half of them being on duty at all times. As a matter of fact, the above shows but too clearly this is not the case; and that in port, where the atmospheric conditions are less favourable, the men at night time will be congregated together.

An attempt has been made by Mr. Mitcalfe, the author of "Suggestions to Managing Owners and their Captains," to refute the acknowledged testimony of experts as to the cubical allowance for each seaman being inadequate. Mr. Mitcalfe appears to close his eyes to the fact that the Royal Commission on Labour of 1894 recommended an increased air space of 120 cubic feet for each man. If at any time Mr. Mitcalfe has been a voyage to the East on a modern cargo steamer, he may have noticed whether ventilators under the present system can always be kept open, particularly in top gallant forecastles, when the vessel is diving bows under in a South-West monsoon. However Mr. Mitcalfe misses the point, because it is not on sea conditions that calculations should be based, but on those which obtain when the vessel is lying in port, where the crew are assembled together in places where they not only sleep but have to live. Moreover, a ship, unlike a house, possesses the disadvantages of interrupted ventilation due to equable temperatures and stormy weather, and also to the material of which everything is constructed.

As stated under the heading of Lower Forecastles, the Merchant Shipping Act of 1894 differs in no sense from that of the 1867 Act with respect to cubic space. They both state that "Every place in any ship occupied by seamen or apprentices, and appropriated to their use, shall have for every such seaman or apprentice a space of not less than 72 cubic feet, and of not less than 12 superficial feet, measured on the deck or floor of such place."

The rule for computing the superficial area of the deck or floor contained in the new "Instructions to Surveyors," 1895, will be of interest. It states in paragraph 62:—"The place being first sufficiently cleared and clean, and in a fit state for measurement, measure the length in a straight line from the foremost boundary of the floor of the crew space (whether such foremost boundary be the stem, or knightheads or water way, or breast hook, or a bulkhead, or that part of the floor beyond which men cannot properly stand or move about) to the aftermost boundary of the floor of the crew space, Divide the length so taken into four equal parts. At each of these points of division, and at the foremost and aftermost boundaries of the crew space, take a breadth across the ship between the boundaries of the side as defined before; number the breadths so taken as Nos. 1, 2, 3, 4, 5, commencing with No. 1 as the foremost boundary, and ending with No. 5 as the aftermost boundary. Multiply the first and last breadths by one, the second and fourth breadths by four, and the third breadth by two. Then multiply the sum of these products by one-third of the distance or common interval between the breadths, and the product will be the gross area of the floor of the crew space. From this gross area deduct the gross area of all incumbrances, such as hatchways, chain pipes, ventilating trunks, windlass, riding bitts, &c., and the remainder will be the clear area of the floor. Divide this clear area by 12, and the quotient will be the number of seamen for which the space is to be certified, provided that the cubic capacity of the space (as afterwards computed) is sufficient for such number of men at 72 cubic feet per man. The measurements are to be taken in feet and tenths of a foot. *Bed bunks or sleeping berths are not to be deducted as incumbrances, but in cabins there should not be less than* 12 *square feet per man exclusive of the bunk, as the spirit of the Act is that each man should have* 12 *clear superficial feet of deck space.*”

The italics are the writer's.

Why the distinction between forecastles and cabins? An interesting instance bearing on this is worthy of note.

A cabin situated in the alley-way of a steamer built in 1875 is occupied by four firemen. Cut into the iron framework over the door are these words: “Certified to accommodate four seamen.” The gross cubical capacity of the cabin is 311·5 cubic feet. The incumbrances are many, and do not appear to have been taken into account; for instance—

Food lockers occupy a space of	14	cubic feet.
Four bunks (including bedding),	20	”
Four regulation life belts ..	2	”
Seats and two tables	0·5	”
Total incumbrances ..	36·5	cubic feet.

Now, deducting the total incumbrances, 36·5 cubic feet, from the gross cubical capacity of cabins, leaves a free air space of 68 cubic feet. This is without making any allowance for personal effects carried in bags or chests.

The floor space per man, inclusive of the bunk, is 12 square feet. Another feature in connection with small cabins is the too great liberty allowed to members of the crew in making additions to these places in the shape of food and clothes lockers, &c., all helping to make the air space less.

As regards the forecastle, an improvement is noticeable on a great many lines, but in many instances it is due to fewer hands being carried than formerly.

MEETINGS HELD APRIL TO JUNE, 1896.

Sessional Meeting.

A meeting was held on April 15th, when a discussion was opened by J. F. J. Sykes, D.Sc., M.D., Medical Officer of Health, St. Pancras, on "Factory and Workshops Acts, and the Powers and Duties of Sanitary Authorities with regard to Workshops." Sir Francis Sharp Powell, M.P., in the Chair. About 150 Members, Associates, and Visitors attended. The paper and discussion is printed in this Journal, see page 113.

EXAMINATIONS.

At an Examination for Inspectors of Nuisances, held at Birmingham on Friday and Saturday, April 10th and 11th, 1896, 31 Candidates presented themselves.

The following 11 Candidates were certified, as regards their Sanitary knowledge, competent to discharge the duties of Inspectors of Nuisances:—

1896, Apr. 11.	Bedingham, Alfred, 86, Fife Street, Nuneaton.
1896, Apr. 11.	Clark, William George Johnson, Surveyor, 32, Bell Street, Wigston Magna, Leicester.
1896, Apr. 11.	Dawe, Miss Elma Cérise, 150, Victoria Road, Aston, Birmingham.
1896, Apr. 11.	Deeley, George Plant, Mousehall Farm, Amblecote, Brierley Hill.
1896, Apr. 11.	Griffiths, Alfred William, 16, Trinity Terrace, Abergavenny.
1896, Apr. 11.	Protheroe, Sidney, 101, Fentham Road, Handsworth, Birmingham.
1896, Apr. 11.	Salt, Arthur, 67, Bloomsbury Street, Birmingham.
1896, Apr. 11.	Starkey, Horace Joseph Alfred, Crescent Road, Willenhall.
1896, Apr. 11.	Thompson, Frank, 44, Chattaway, St. Nechells.
1896, Apr. 11.	Walker, Herbert, 35, Shireland Road, Smethwick, Birmingham.
1896, Apr. 11.	Withers, Arthur, 30a, Thynne Street, West Bromwich.

EXAMINATION QUESTIONS.

Examination for Inspectors of Nuisances.—Birmingham, April 10th and 11th, 1896. The following questions were set to be answered in writing on the 10th, and the candidates were examined *vivâ voce* on the 11th.

1.—What are the chief points laid down in the regulations of the Local Government Board under the Canal Boats Act, 1877, with regard to cubic space, ventilation, offensive cargoes, removal of bilge water, and water supply?

2.—State your objections (if any) to a bakehouse below the level of the street. What are the special points applicable to bakehouses under the Factory and Workshops Acts of 1878, 1883, 1891, and 1895?

3.—Describe the business of a bone-boiler, and detail the various precautions that must be taken to prevent the business being a nuisance to the surrounding neighbourhood?

4.—What are the characteristics of water obtained—

(*a*) From a moor?
(*b*) From a well sunk in the chalk?

Would the water from either source be likely to affect cisterns and service pipes?

5.—It is considered advisable after a case of Typhoid Fever, to disinfect and purify the whole of the sanitary arrangements of a house. State what steps should be taken to carry this out in regard to water closets, soil pipes, drains, gulleys, sinks, baths, lavatory basins, and their waste pipes.

6.—Give an exact specification for ventilating a sleeping room without a fire-place, to be occupied by four adults. The room is 30 ft. by 10 ft. and 10 ft. high; one 30 ft. wall and one 10 ft. wall being external, the only window being in the 30 ft. wall. State the size, position, and description of the openings which you would recommend.

7.—Show by sketches in plan and section how to drain a terrace house, with two water-closets (one in front and one in rear of the house), a bath, and a sink.

8.—What are the chief points by which you would determine whether a water-closet is well constructed? Sketch a good form of closet and the junction of the service pipe with it and also with the waste preventer; give dimensions on the sketch.

9.—Sketch an earth-closet and explain the circumstances under which it should be adopted and how it should be attended to.

At an Examination in Practical Sanitary Science, held under the auspices of The Sanitary Institute, on May 8th and 9th, 32 Candidates presented themselves. Questions were set to be answered in writing on the 8th, and the Candidates were examined *vivâ voce* on the 9th.

The following 22 Candidates were granted Certificates in Practical Sanitary Science:—

1896, May 9. Baxter, William, 5, Florence Road, Stroud Green.
1896, May 9. Clarke, John Henry, Vestry Hall, Chiswick.
1896, May 9. Cook, Christopher Berney, 3, Broomhouse Road, Parsons Green.
1896, May 9. Fricker, James Percy, 55a, High Street, Kingston-on-Thames.
1896, May 9. Greatorex, John Lowe, 16, Ringford Road, Wandsworth, S.W.
1896, May 9. Gregory, Joseph Dalton, 19, Greenhill Street, Greenheys, Manchester.
1896, May 9. Hayward, Thomas William Alfred, Lynton Villa, Weston-super-Mare.
1896, May 9. Herbert, David William, Cilrhedyn Rectory, Llanfyrnach, Pembroke.
1896, May 9. Hopkins, Percy Alfred, 37, Mortimer Street, W.
1896, May 9. Hudson, Edward Reginald, 16, Inglis Road, Southsea.
1896, May 9. Kershaw, Robert, 55, Eaton Rise, Ealing.
1896, May 9. Norris, J. Foxley, 13, Alkham Road, Stoke Newington.
1896, May 9. North, Edward, 6, Grove Road North, Southsea.
1896, May 9. Pike, Edmund, Lynton, Torquay.
1896, May 9. Ratcliffe, John Charles, Holly Leigh, Longfield, Urmston. Manchester.
1896, May 9. Sisterson, Thomas, May Cottage, Sidmouth, Devon.
1896, May 9. Switzer, Sidney A., 9, Derby Street, Gray's Inn Road, W.C.
1896, May 9. Taylor, Francis Robert, 16, Arodene Road, Brixton Hill.
1896, May 9. U'Ren, Harry Way, 104, Elliscombe Road, Old Charlton, Kent.
1896, May 9. Welfare, Ernest John, 37, Acre Lane, Brixton, S.W.
1896, May 9. Wilson, William Thomas, Royal Agricultural College, Cirencester.
1896, May 9. Wiltshier, Archibald, 34, Wathing Street, Canterbury.

EXAMINATION QUESTIONS.

Examination in Practical Sanitary Science.—London, May 8th and 9th, 1896. The following questions were set to be answered in writing on the 8th, and the candidates were examined *vivâ voce* on the 9th.

1.—What precautions should be taken to secure a healthy site for a dwelling-house to be erected—

(*a*) Upon the side of a clay hill;
(*b*) Upon fen land;
(*c*) Upon a sandy soil containing springs?

2.—Describe in detail the arrangement for the water supply of a town house four storeys high; state the best position for cisterns and pipes, and what precautions should be taken to protect them from frost.

3.—Describe the best materials you know of from a sanitary point of view for—

(*a*) Dormitory floors;
(*b*) Workroom floors below the ground line.

Illustrate the construction by sectional sketches to a scale of 1 in. to the foot.

4.—Explain the relative sanitary advantages and disadvantages of walls and the following materials—

Ordinary brick wall 9 inches thick.
Stone rubble wall 20 inches thick.
Stone-faced hollow wall 18 inches thick.

5.—State the best position for a "damp course" in walls, and name the various materials in general use; give a careful description of the method of construction you prefer.

6.—Describe four methods of introducing fresh air into the rooms of a terrace house; and explain by sketches four methods of removing the vitiated air from the same rooms. State which you consider the best methods.

7.—What are the best methods of testing house drains, and how are these methods applied?

8.—Sketch a line of pipe sewer with the connections of house drains.

9.—Describe in detail how drains and sewers should be ventilated?

At an Examination for Inspectors of Nuisances, held in London on Friday and Saturday, May 8th and 9th, 1896, 142 Candidates presented themselves. Questions were set to be answered in writing on the 8th, and the Candidates were examined *vivâ voce* on the 9th.

The following 81 Candidates were certified, as regards their Sanitary Knowledge, competent to discharge the duties of Inspectors of Nuisances:—

1896, May 9. ADAMS, Miss CONSTANCE LOUISA, c/o Mrs. Adams, Hampton Court Palace.
1896, May 9. ALLEN, Miss MARGARET, 1, Lloyd Street, Lloyd Square, W.C.
1896, May 9. BACKHOUSE, THOMAS NOAH, 122, Ennersdale Road, Lewisham.
1896, May 9. BAGSHAW. JAMES RICHARD, 47, King Square, E.C.
1896, May 9. BALDEN, JOHN, M.R.C.V.S., Leighton Buzzard.
1896, May 9. BARRY, ARTHUR THOMAS, 9, Bismark Road, Archway Road, Highgate.
1896, May 9. BRETT, ERNEST JOHN, Westborough, Wimborne Dorset.
1896, May 9. BROWN, WILLIAM, 6, Prospect Place, Worthing.
1896, May 9. BYSOUTH, WILLIAM HERBERT, 47, Spurstowe Road, Hackney.
1896, May 9. CAREY, JOHN GEORGE, Gloucester House, Datchet.
1896, May 9. CLARK, JAMES, 35, Annis Road, South Hackney.
1896, May 9. COBB, WILLIAM HENRY, 15, Colston Road, Shrewsbury Road, East Ham.
1896, May 9. COLLYER, JAMES, 54, Victoria Road, Watford.
1896, May 9. COOK, FREDERICK CHARLES, 33, High Street, Worthing.
1896, May 9. COX, HENRY EDWIN, 19, Rokeby Road, Brockley.
1896, May 9. CURWEN, Miss MAUD, 23, Somerset Terrace, Tavistock Square, W.C.
1896, May 9. DAVIES, JAMES THOMAS, 170, Manchester Road East, Little Hulton, Bolton.
1896, May 9. DAY, JOHN FRANCIS, 45, Green Lane, Kettering.
1896, May 9. DE ALBERTI, Miss AMALIA, 43, Cotleigh Road, West Hampstead.
1896, May 9. DIVER, DANIEL, J., 105, Ewart Road, Forest Hill.
1896, May 9. EDE, WALTER JOSEPH, 20, Norfolk Road, Brighton.
1896, May 9. ELLIOTT, WILLIAM CHARLES, 20, Camden Road, Tunbridge Wells.
1896, May 9. FAIRCHILD, THOMAS AUGUSTUS, High Road, Upper Clapton, N.E.
1896, May 9. FRAME, ALEXANDER, 16, The Albany, Camberwell, S.E.
1896, May 9. FRANKLIN, EDWARD, 45, Crowndale Road, N.W.
1896, May 9. GARDINER, Miss BLANCHE, 11, Victoria Road, Leicester.

1896, May 9. Gibson, Miss Margaret Vincent, 9, Powis Gardens, Bayswater.
1896, May 9. Grennon, Luke, 23, Lacy Terrace, Gravesend.
1896, May 9. Hamilton, Benjamin William, 105, New Church Street, Bermondsey.
1896, May 9. Hawkins, Thomas Henry, 30, Stirling Street, Buckland, Portsmouth.
1896, May 9. Hawkins, Walter, 66, Grosvenor Terrace, Camberwell.
1896, May 9. Head, Arthur, 14, Merredene Street, Brixton Hill.
1896, May 9. Hodges, Arthur, London Hotel, High Street, Poole.
1896, May 9. Jones, Mrs. Sarah Ann, 19, Cavendish Road, Harringay.
1896, May 9. Kain, Frederick William, 1, Pelton Villas, Brighton Road, Sutton.
1896, May 9. Keene, Frederick Charles, Ardenville, Wimborne Road, Winton, Bournemouth.
1896, May 9. Kelsey, Mrs. Caroline Eliza, 13, Berkeley Road, Crouch End.
1896, May 9. King, James William, 12, Bishop's Road, West Croydon.
1896, May 9. Lake, Richard, Old Fore Street, Sidmouth, Devon.
1896, May 9. Lambert, Walter Scarlett, 56, Leytonstone Road, Stratford.
1896, May 9. Lindon, Alfred Abraham, 50, Mayton Street, Holloway.
1896, May 9. Long, Samuel, 66, Grosvenor Terrace, Camberwell.
1896, May 9. Lonnon, John Imrie, 5, St. James' Mansion, Holloway.
1896, May 9. Lovell, Samuel George, 73, The Crescent, South Tottenham.
1896, May 9. Males, Nelson, 191, Albany Street, Regent's Park, N.W.
1896, May 9. Masters, William Henry, 21, Whitfield Street, Tottenham Court Road.
1896, May 9. Mathieson, David John, 11, Little Welbeck St., W.
1896, May 9. May, Hubert Harry, 49, Albert Road, South Norwood, S.E.
1896, May 9. Muntzer, Frederick George, 8, Standish Road, King Street West, Hammersmith.
1896, May 9. Newland, Henry, 11, Artillery Road, Guildford.
1896, May 9. Nichol, Frank, 135, Newington Butts, S.E.
1896, May 9. Nicholls, Edward A., 8, Springfield Road, New Southgate.
1896, May 9. Nicholson, Thomas, 41, Newbury Road, Bromley, Kent.
1896, May 9. Nye, Albert William, 34, Duke Street, Brighton.
1896, May 9. Parker, Harry Edward, 62, Cecil Road, Upton Manor, E.

1896, May 9. Patching, George Cannon, 31, St. John's Road, Faversham.
1896, May 9. Perks, William Henry, 35, Duncombe Road, N.
1896, May 9. Petty, Miss Georgianna Levie, 6, High Road, South Tottenham.
1896, May 9. Petty, Miss Rose Frances, Nursing Home, London Hospital, E.
1896, May 9. Pooley, Arthur Henry, 31, Bedford Street, South Heigham, Norwich.
1896, May 9. Porter, Thomas Gabriel, 6, Jackson Road, Holloway, N.
1896, May 9. Pratt, Thomas Henry, 64, Romilly Road, Finsbury Park.
1896, May 9. Prosser, Albert Willie Gregory, Brereton Road, Bedford.
1896, May 9. Radcliffe, Albert Edward, 3, Albert Villas, Lindley Road, Leyton.
1896, May 9. Raine, Henry Edward, 134, Edward Street, New Cross, S.E.
1896, May 9. Raine, William, 34, Shere Road, Deptford, S.E.
1896, May 9. Rhodes, George, 32, Osborn Road, Thornton Heath.
1896, May 9. Roberts, George, 14, Milton Road, Herne Hill, S.E.
1896, May 9. Safford, Miss Ada Josephine, 34, Cedars Road, Clapham Common.
1896, May 9. Sanderson, John, 15, St. John Street, Islington, N.
1896, May 9. Shepherd, William, 5, Church Row, Hampstead.
1896, May 9. Smith, William, 19, Barnsbury Grove, N.
1896, May 9. Stafford, Harry, 30, Mill Road, Lewisham.
1896, May 9. Taylor, Henry John, 21, Upper Paget Road, Plumstead.
1896, May 9. Tebbitt, Harold Stanton, Burcott House, Wokingham, Berks.
1896, May 9. Tilston, William Herbert, 18, Clifton Crescent, Birkenhead.
1896, May 9. Vines, Miss Mabel Mary, 188, Adelaide Road, Brockley, S.E.
1896, May 9. Wakeford, Joseph Henry, 12, Victoria Street, Landport, Portsmouth.
1896, May 9. Wigley, Alfred, 12, Winstone Road, Newington Green, N.
1896, May 9. Winn, William Warren, 12, Grove House Road, Hornsey.
1896, May 9. Wright, Edward Michael Stanley, 69, Marville Road, Fulham.

EXAMINATION QUESTIONS.

Examination for Inspectors of Nuisances.—London, May 8th and 9th, 1896. The following questions were set to be answered in writing on the 8th, and the candidates were examined *vivâ voce* on the 9th.

1.—State fully what powers of entry into workshops are given to Sanitary Authorities, and for what purposes.

2.—What are the principal causes of water pollution within a dwelling-house, and how can they be avoided?

3.—What is meant by Constant and by Intermittent water supply? What dangers may arise from either?

4.—Describe the various signs and appearances of Beef—(*a*) when decomposing; (*b*) when derived from an animal that has died of disease; (*c*) when of poor quality.

5.—Enumerate the diseases mentioned in the Infectious Diseases Notification Act, 1889. In the case of the exposure of an infected person, what details of evidence should be obtained if the Sanitary Authority decides to prosecute?

6.—Describe step by step the precautions to be taken to prevent infection spreading from a case of small-pox.

7.—How many gallons of water would be contained in a square tank which measures 23 feet along each side of the bottom, the sides sloping outwards at an angle of 45°, and the water being 7 feet 6 inches deep? What would be the area of the surface of the water?

8.—How would you detect the escape of sewer gas within a house, from the drains?

9.—Sketch distinctly the drainage arrangements for a two-storey building, with w.c. and bath on the first floor, a urinal, lavatory, and kitchen sink on the ground floor. Show the trapping and ventilation.

At an Examination for Inspectors of Nuisances, held at Newcastle-upon-Tyne on Friday and Saturday, June 5th and 6th, 1896, 24 Candidates presented themselves.

The following Candidates were certified as regards their Sanitary knowledge competent to discharge the duties of Inspectors of Nuisances:—

1896, June 6.	Chisholm, George, Wells Road, Boldon Colliery, Durham.
1896, June 6.	Dodd, Thomas, 16, Woodbine Terrace, Felling-on-Tyne.
1896, June 6.	Hardy, William Verrill, 22, Zion Terrace, Newcastle Road, Sunderland.
1896, June 6.	Kirkup, John Little, Cemetery Lodge, Wingate R.S.O., Ferry Hill, County Durham.
1896, June 6.	Knewstubb, Joseph John, Pembroke Street, Appleby, Westmoreland.
1896, June 6.	McNicholl, James, 2, Addison Street East, Hendon, Sunderland.
1896, June 6.	Mease, Joseph Mellamby, Hutton Rudby, Yarm.
1896, June 6.	Scott, Edward Welsh, The Hermitage, Chester-le-Street.
1896, June 6.	Wilkinson, Michael Hutchinson, Flavia Terrace, Lawe Road, South Shields.

EXAMINATION QUESTIONS.

Examination for Inspectors of Nuisances.—Newcastle-upon-Tyne, June 5th and 6th, 1896. The following questions were set to be answered in writing on the 5th, and the candidates were examined *vivâ voce* on the 6th.

1.—What constitutes a dwelling? Enumerate the various kinds of dwellings. Under what legal restrictions are some dwellings occupied?

2.—Mention the principal offensive trades. Select any one of them, and give the substance of the Model Bye-laws relating thereto.

3.—Enumerate the parasites of human food with which you are acquainted. Describe their appearance to the naked eye, and the effect produced upon the consumer.

4.—Which is the more efficient means of disinfection, steam or hot air, and why? State what would be the effect produced by each respectively upon a feather bed, a new blanket, and a pair of boots.

5.—What should be the dimensions of a sleeping room to accommodate four adults; to what height would you restrict it, and why? What means of ventilation should be provided, and what should be the size of the ventilating openings?

6.—In inspecting a stream which is complained of as a nuisance, to what points would you direct your attention with a view to making a report?

7.—What are the characteristics of hard and of soft water?

8.—What are the essential features of good house drainage, and what are the dangers to be avoided?

9.—Write a short specification for the laying of a 6-inch stoneware soil drain under a house.

So few Meetings are held during this Quarter that the usual Calendar is omitted.

FORTHCOMING MEETINGS.

JULY TO SEPTEMBER, 1896.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Finance Committee . . .	Second Wednesday at 4 p.m.
Exhibition Committee . . .	First Tuesday at 5 p.m.
Congress and Editing Committee .	Second Monday at 5.15 p.m.
Education Committee . . .	Third Monday at 5 p.m.
Museum and Library Committee .	Fourth Monday at 5 p.m.

During August and September these meetings are suspended.

LECTURES AND DEMONSTRATIONS FOR SANITARY OFFICERS AND STUDENTS.

The Twenty-Second Course of Lectures will commence on September 21st.

CONGRESS AND EXHIBITION OF THE INSTITUTE, 1896.

The Congress and Exhibition will be held this year at Newcastle-upon-Tyne, by invitation of the Mayor and Corporation. The Council are glad to announce that H.R.H. THE DUKE OF CAMBRIDGE, President of the Institute, has graciously consented to be present at the meeting and to open the Exhibition. The Right Hon. Earl Percy, P.C., has consented to act as President.

The Mayor has consented to act as Chairman of the Local Committee, and Dr. H. E. Armstrong, M.O.H. of the City of Newcastle, and Dr. Hembrough, M.O.H. for the County, have been appointed as Hon. Local Secretaries.

It will be within the memory of many of the members that the Institute visited Newcastle in 1882, and the hearty welcome that they received in those early days of the Institute make sure of a successful meeting on this occasion.

The Congress is to open on Wednesday, September 2nd, and extend to the following Wednesday; this alteration of the days having been suggested as more agreeable to the members.

A programme of the arrangements as far as they have been decided at present will be found on the following pages. The buildings which are proposed for the meetings are very appropriate and well situated.

THE
FIFTEENTH CONGRESS, 1896.
WILL BE HELD AT
NEWCASTLE-UPON-TYNE,
From SEPTEMBER 2nd to SEPTEMBER 9th.

GENERAL ARRANGEMENTS.

ADDRESSES AND LECTURES.

President's Inaugural Address.
Lecture to the Congress.
Popular Lecture.

SECTIONS.

Section I.—Sanitary Science and Preventive Medicine.
Section II.—Engineering and Architecture.
Section III.—Chemistry, Meteorology and Geology.

CONFERENCES.

Of Port Sanitary Authorities.
Of Medical Officers of Health.
Of Municipal and County Engineers.
Of Sanitary Inspectors.
Of Ladies on Domestic Hygiene.

H.R.H. THE DUKE OF CAMBRIDGE, K.G.,
PRESIDENT OF THE INSTITUTE,

Has graciously consented to open the Exhibition of Apparatus and Appliances relating to Health and Domestic use, which will be held in connection with the Congress.

PAPERS AND DISCUSSIONS.

The Council invite Papers on subjects relating to Health and Sanitary Science. Papers are limited to twenty minutes in reading. A short abstract must accompany every Paper, both for the convenience of the Press at the Congress and for insertion, subject to the approval of the Council, in the Journal of the Institute, should it not be deemed desirable to publish the Paper *in extenso*. No previously published Paper can be read. The acceptance of Papers, and the days on which they are to be read, are determined by the Council before the beginning of the Meeting. The Council reserve the right of refusing any Papers sent in; and in the case of those accepted, the reading of them must depend on the time at the disposal of the Meeting. Papers read at the Congress cannot be published by the Authors, except by permission of the Council. The Council reserve to themselves the privilege of printing any Paper read at the Congress, either wholly or in part, or of refraining from the publication thereof, if they see fit.

The Addresses and Papers or Abstracts thereof are usually printed by the Institute in London before the meeting of the Congress, and may be purchased from the Secretary of the Institute during the Congress. Authors should forward their manuscript by book post *as early as possible before August 2nd*, addressed to the Secretary, Sanitary Institute, Margaret Street, London, W.

RECEPTION ROOM AND PLACES OF MEETING.

A Reception Room will be opened at THE COLLEGE OF MEDICINE, on TUESDAY, SEPTEMBER 1ST, at 12 NOON, and on the following days at 9 A.M. for the issue of all Tickets in connection with the Congress.

The Inaugural Address of the President and the Lectures to the Congress will be given in THE UNIVERSITY OF DURHAM COLLEGE OF MEDICINE.

The Sectional Meetings, General Meetings, and Conferences will be held in THE UNIVERSITY OF DURHAM COLLEGE OF MEDICINE.

The Popular Lecture will be given in THE TOWN HALL.

HOTEL AND LODGING ACCOMMODATION, AND TRAVELLING ARRANGEMENTS

Will be determined by the Local Committee, and information relating to the same may be obtained from the Honorary Local Secretaries, Town Hall, Newcastle-upon-Tyne.

TICKETS.

Fellows, Members, and Associates of the Institute are supplied with Tickets for the Congress on application to the Secretary before the Congress, or may be obtained at his Office in THE UNIVERSITY OF DURHAM COLLEGE OF MEDICINE during the Meeting.

To those not connected with the Institute Congress Tickets will be issued, entitling the holder to the use of the Reception Room, to admission to the Presidential and other Addresses, to all Meetings, to the Exhibition of the Institute, and to any Conversazione given by the Institute. The price of the Congress Tickets is Half-a-guinea each. These Tickets may be obtained at the Secretary's Office, in THE UNIVERSITY OF DURHAM COLLEGE OF MEDICINE, or at the Office of the Hon. Local Secretaries at THE TOWN HALL.

EXCURSIONS.

Particulars of these will be published in a later Programme, and Tickets and List of Places to be visited can be obtained at either the Secretary's Office or the Office of the Hon. Local Secretaries during the Meeting.

Officers of the Congress

President.

THE RIGHT HON. THE EARL PERCY, P.C., D.L., J.P.,
Chairman of the Northumberland County Council.

Vice-Presidents.

Most Hon. The MARQUESS OF LONDONDERRY, P.C.
Rt. Hon. Sir MATTHEW WHITE RIDLEY, Bart., M.P., J.P.
The Right Worshipful The MAYOR OF NEWCASTLE-UPON-TYNE.
The SHERIFF OF BERWICK-UPON-TWEED.
The SHERIFF OF NEWCASTLE.
The Right Rev. The BISHOP OF NEWCASTLE.
The Right Rev. The BISHOP OF HEXHAM AND NEWCASTLE.
The Right Rev. The BISHOP OF DURHAM.
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Lieut.-Gen. Sir H. HAVELOCK-ALLAN, Bart, M.P.
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Col. Sir E. T. GOURLEY, M.P.
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T. CRAWFORD (Chairman Walker, U.D.C.).
G. S. KELLY (Chairman Alnwick, U.D.C.).
U. PATTERSON (Chairman Blaydon, U.D.C.).
HERBERT W. BELL (Town Clerk, Hartlepool).
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J. M. L. CRIDDLE (Under-Sheriff).
W. L. DAGLISH (Town Clerk, Jarrow.)
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The Very Revd. Dr. KITCHIN (Dean of Durham).
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Rev. A. ROBERTSON, D.D. (Principal of Bishop Hatfield's Hall, Durham).
S. SANDERSON (Clerk of the Peace for Northumberland).
Rev. J. R. SHORTT, M.A.
H. SIMMS.
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Alderman JOHN FOSTER SPENCE.
F. T. STEAVENSON, J.P. (Town Clerk, Darlington).
J. C. STEVENSON (Chairman River Tyne Commissioners).
SAMUEL STOREY, J.P., D.L. (Chairman Durham County Council).
R. URWIN (Sec. Tyne Improvement Commission).
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UNITED STATES ...	W. S. CAMPBELL.

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J. W. HEMBROUGH, M.D., M.R.C.S., Medical Officer of Health, Northumberland County Council.

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J. W. HEMBROUGH, M.D., M.R.C.S., }

County Councils, Corporations, and Local Authorities, who have up to the present appointed Delegates to the Congress.

The County Councils of:

- Aberdeen.
- Clackmannanshire.
- London.
- **Dumfriesshire.**

The County Boroughs of:

- Birmingham.
- Brighton.
- Bristol.
- Derby.
- Exeter.
- Gateshead.
- Hanley.
- Kingston-on-Hull.
- Leeds.
- Liverpool.
- Newport.
- Preston.
- **Rochdale.**
- **South Shields.**
- **St. Helens.**
- **West Bromwich.**
- **Worcester.**

The Urban District Councils of:

- Alnwick.
- Amble.
- Bacup.
- Barnet.
- Barrhead.
- Barnsley.
- Bath.
- Batley.
- Benfieldside.
- Bishop Auckland.
- Blaydon.
- Brandon & Byshottles.
- Chelmsford.
- Dewsbury.
- Easington.
- Eastbourne.
- Eston.
- Exmouth.
- Felling.
- Folkestone.
- Hackney Vestry.
- Hexham.
- Jarrow.
- Kidderminster.
- Leith.
- Lisburn.
- Middlewich.
- Mountain Ash.
- Nelson.
- Newburn.
- Oswestry.
- Otley.
- Pembroke, Co. Dublin.
- Shelf.
- Shilden & East Thickley.
- St. Mary, Newington, Vestry.
- St. Thomas.
- Stockton-on-Tees.
- Warley.
- Watford.
- Whitstable.
- Winsford.

The Rural District Councils of:

- Alnwick.
- Barton-upon-Irwell.
- Basford.
- Bolton.
- Brampton.
- East & West Hegg.
- Haltwhistle.
- Holywell.
- Hunslet.
- Lanchester.
- Morpeth.
- Ripon.
- South Shields.
- Stockton.
- Sunderland.

Port Sanitary Authorities:

London.

Societies who have appointed Delegates to the Congress.

- Architectural Association.
- British Institute of Preventive Medicine.
- British Society of Mining Students.
- Institute of Chemistry of Great Britain and Ireland.
- Institution of Mechanical Engineers.
- Liverpool Engineering Society.
- Medical Society of London.
- North-Western Sanitary Inspectors' Association.
- Northumberland and Durham Sanitary Inspectors' Association.
- Royal College of Physicians, Edinburgh.
- Scottish Meteorological Society.
- Shipmasters' Society.
- Society of Chemical Industry.
- Society of Public Analysts.
- Yorkshire Branch Sanitary Inspectors' Association.

Proceedings of the Congress and Officers of Sections and Conferences.

ADDRESSES AND LECTURES.

Inaugural Address to the Congress

BY THE RIGHT HON. EARL PERCY, P.C., D.L., J.P.

to be given in THE UNIVERSITY OF DURHAM COLLEGE OF MEDICINE, *on Wednesday, September 2nd, at* 8 *p.m.*

Lecture to the Congress

BY A. WYNTER BLYTH, M.R.C.S., F.I.C., F.C.S., BARRISTER-AT-LAW., Chairman of Council of the Sanitary Institute,

to be given in THE UNIVERSITY OF DURHAM COLLEGE OF MEDICINE, *on Friday, September 4th, at* 8 *p.m.*

Popular Lecture

BY SIR CHARLES A. CAMERON, M.D., D.P.H.CAMB., M.R.C.P., F.I.C.

to be given in THE TOWN HALL, *on Tuesday, September 8th, at* 8 *p.m.*

SECTIONAL MEETINGS.

Section I.—"Sanitary Science and Preventive Medicine."

Friday, September 4th, to be held in THE UNIVERSITY OF DURHAM COLLEGE OF MEDICINE.

President.

Vice-Presidents.

PROF. GEORGE HARE PHILIPSON, M.A., M.D., D.C.L., F.R.C.P.
PROF. T. OLIVER, M.A., M.D., F.R.C.P.

Hon. Secretaries.

J. F. J. SYKES, M.D., D.SC. | HAROLD SCURFIELD, M.D., D.P.H.

Section II.—"Engineering and Architecture."

Monday, September 7th, to be held in THE UNIVERSITY OF DURHAM COLLEGE OF MEDICINE.

President.

SIR BENJAMIN C. BROWNE, M.INST.C.E.

Vice-President.

D. BALFOUR, M.INST.C.E., F.G.S., F.R.MET.SOC.
ALEXANDER R. BINNIE, M.INST.C.E., F.G.S.
JOSEPH OSWALD, F.R.I.B.A.
J. WIGHAM RICHARDSON, J.P.
A. HESSELL TILTMAN, F.R.I.B.A.

Hon. Secretaries.

MAJOR LAMOROCK FLOWER. | OSWALD L. FALCONAR, A.I.B.E.

Section III.—"Chemistry, Meteorology, and Geology."

Tuesday, September 8th, to be held in The University of Durham College of Medicine.

President.

W. H. Dines, B.A., F.R.MET.SOC.

Vice-Presidents.

Prof. Henry Stroud, M.A.CANTAB., D.SC.LOND.
Prof. P. Phillips Bedson, M.A., D.SC.LOND., F.I.C., F.C.S.
Prof. G. A. Lebour, M.A., F.G.S.

Hon. Secretaries.

G. J. Symons, F.R.S. | Saville Shaw, F.C.S.

CONFERENCES.

Of Port Sanitary Authorities.

Thursday, September 3rd, to be held in The University of Durham College of Medicine.

President.

Arthur Holt-Barber,
Chairman Port of London Sanitary Authority.

Vice-Presidents.

Alderman Eva Fraser, Chairman Hull and Goole Port Sanitary Authority.
J. J. O'Meara, „ Dublin Public Health Committee.
W. Edmund Harker, M.B., B.S.DURH.
E. W. Hope, M.D., D.SC.
J. Wright Mason, M.B., D.P.H., M.R.C.S.

Hon. Secretaries.

W. Collingridge, M.A., M.D., D.P.H. | Reginald Green, M.D., B.HY.
W. G. Richardson, M.B., F.R.C.S.

This Conference is open to all Members and Officials of Port Sanitary Authorities.

Of Medical Officers of Health.

Thursday, September 3rd, to be held in The University of Durham College of Medicine.

President.

Alfred Hill, M.D., F.R.S.E., F.I.C., F.C.S.

Vice-Presidents.

Henry E. Armstrong, D.HY., M.R.C.S.
J. E. Gofton, M.R.C.S.ENG., L.R.C.P.LOND.
N. Hardcastle, M.R.C.S., L.S.SC.
T. Eustace Hill, M.B., B.SC., F.I.C.
James Robert Kaye, M.B., D.P.H.

Of Municipal and County Engineers.

Thursday, September 3rd, to be held in Durham College of Science.

President.

Francis J. C. May, M.Inst.C.E. (Borough Engineer, Brighton).

Vice-Presidents.

J. W. Brown, Assoc.M.Inst.C.E. (Borough Engineer, West Hartlepool).
Wm. Crozier, Assoc.M.Inst.C.E. (County Surveyor, Durham).
Matthew Hall (Borough Engineer, South Shields).
H. S. Kynnersley, M.Inst.C.E. (County Surveyor, Northumberland).
R. S. Rounthwaite, Assoc.M.Inst.C.E. (Borough Engineer, Sunderland).

Hon. Secretaries.

Harry W. Taylor, F.S.I., F.R.M.S.

This Conference is open to all Municipal and County Engineers.

Of Sanitary Inspectors.

Thursday, September 3rd, to be held in The University of Durham College of Medicine.

President.

George Reid, M.D., D.P.H.

Vice-Presidents.

Wm. Bland (Chairman, North-Western Sanitary Inspectors' Association).
G. W. Branson (Chairman, Northampton and adjoining Counties' Branch Sanitary Inspectors' Associations.).
W. H. May (Chairman Institute of Certificated Sanitary Inspectors).
H. Thomas (Chairman, The Sanitary Inspectors' Association).
David Travis (Chairman, Yorkshire and adjoining Counties' Branch Sanitary Inspectors Association).
J. E. Parker, Assoc.M.Inst.C.E. | W. P. Pattison.
W. H. Wells.

Hon. Secretaries.

Albert Taylor.
Wm. Gillender. | Wm. Hudspeth.

This Conference is open to all Sanitary Inspectors and Inspectors of Nuisances.

On Domestic Hygiene.

Thursday, September 3rd, to be held in The School Room of the Presbyterian Church.

President.

The Mayoress of Newcastle-upon-Tyne.

Vice-Presidents.

Mrs. J. A. Angus.
Mrs. H. E. Armstrong.
Mrs. P. P. Bedson.
Miss Davies.
Mrs. G. Harkus.
Mrs. J. W. Hembrough.
Mrs. T. Eustace Hill.
Miss G. E. Rocliffe.
Mrs. T. B. Sanderson.
Mrs. T. Coke Squance.
Mrs. W. H. Stephenson.
Mrs. E. Stont.
Mrs. R. Spence Watson.
Mrs. G. E. Williamson.
Mrs. A. H. Wilson.

Hon. Secretaries.

Mrs. H. W. Newton. | Mrs. H. Scurfield.

This Conference is open to all Ladies interested in Domestic Hygiene.

Order of Proceedings.

WEDNESDAY, SEPTEMBER 2ND.

1 p.m.—Reception of the Members of the Congress.

1.30 p.m.—Public Luncheon.

3 p.m.—Opening of the Exhibition in Olympia.

8 p.m.—Inaugural Address to the Congress in The University of Durham College of Medicine.

THURSDAY, SEPTEMBER 3RD.

10.30 to 2 p.m.—Conferences in The University of Durham College of Medicine and Durham College of Science *(See page 192).*

8 p.m.—Lecture to the Congress in the College of Medicine.

FRIDAY, SEPTEMBER 4TH.

10.30 to 2 p.m.—Meeting of Section I. *(See page 191).* **President's Address and Papers and Discussions on "Sanitary Science and Preventive Medicine."**

Note.—Papers and Discussions will be continued on the following day.

SATURDAY, SEPTEMBER 5TH.

Excursions.

MONDAY, SEPTEMBER 7TH.

10.30 to 2 p.m.—Meeting of Section II. *(See page 191).* **President's Address and Papers and Discussions on "Engineering and Architecture."**

Note.—Papers and Discussions will be continued on the following day.

7 p.m.—Congress Dinner (number of Tickets limited—date not finally settled).

TUESDAY, SEPTEMBER 8TH.

10.30 to 2 p.m.—Meeting of Section III. *(See page 192).* **President's Address and Papers and Discussions on "Chemistry, Meteorology, and Geology."**

5 p.m.—Closing General Meeting of the Congress in The University of Durham College of Medicine.

8 p.m.—Popular Lecture in the Town Hall.

WEDNESDAY, SEPTEMBER 9TH.

Excursions.

Excursions and Visits to places of interest will be made during the Congress.

[*Particulars will be given in future Programmes.*]

THE HEALTH EXHIBITION

WILL BE HELD IN

OLYMPIA,

NEWCASTLE-UPON-TYNE,

AND WILL BE OPENED BY

H.R.H. THE DUKE OF CAMBRIDGE, K.G.,

On WEDNESDAY, SEPTEMBER 2nd, and will remain open till SEPTEMBER 26th, 1896.

The Exhibition is held in connection with the Fifteenth Autumn Congress of The Sanitary Institute, and includes Sanitary Apparatus and Appliances, and Articles of Domestic Use and Economy.

Applications for Space must be made on the Official Form and under the proper class. They must be sent to Mr. W. H. Knight, the Curator of the Exhibition, at the Offices of the Institute, Margaret Street, London. W., not later than Saturday, August 8th, 1896.

The Scale of Charge for Floor Space will be 15s. per Foot frontage, with a depth of six feet. Corners and Special Places will be charged at higher rates. Wall space, 1s. per square foot. No Floor Space will be allotted for less than three feet frontage, or Wall Space for less than five square feet. *All charges must be paid at the time of allotment.*

Silver and Bronze Medals will be awarded at the discretion of the Judges, and their decisions will in all cases be final. A complete classified List of all Awards from the commencement of the series of Exhibitions is published by the Institute.

Protection in accordance with the Patents, Designs, and Trade Marks Act, 1883, will be obtained from the Board of Trade for persons desirous of exhibiting New Inventions.

Forms of Application for Space and other particulars can be obtained of the Curator at the Offices of the Institute, 72, Margaret Street, W.

FELLOWS, MEMBERS, AND ASSOCIATES ELECTED.

From April to June, 1896, inclusive.

FELLOWS (Fell. San. Inst.)

966 1896. June. Eayrs, John Thomas, M.INST.C.E., F.S.I., *Borough Surveyor, Town Hall, West Bromwich.*

414 1896. June. Searles-Wood, Herbert Duncan, F.R.I.B.A., 157, *Wool Exchange, E.C.*

MEMBERS (Mem. San. Inst.)

*** Marked thus have passed the Examination of the Institute in Practical Sanitary Science.**

† Marked thus have passed the Examination of the Institute for Local Surveyor.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

964 1896. May. †Ball, Charles Francis, ASSOC.M.INST.C.E., 51, *Prince Street, Bristol.*

935 1896. April. Bond, William Arthur, M.A., M.D., D.P.H., *Medical Officer of Health, Town Hall, Holborn, W.C.*

966 1896. April. Branthwaite, Robert Welsh, L.R.C.P.LOND., M.R.C.S., D.P.H.LOND., *The Cedars, Rickmansworth, Herts.*

975 1896. June. Coleman, Thomas Everit, *Surveyor, R.E.C.S., Royal Engineer's Office, Gosport.*

976 1896. June. *‡Cook, Christopher Berney, 3, *Broomhouse Road, Parsons Green, S.W.*

969 1896. May. ‡Dolamore, Frederick Percy, *Borough Surveyor's Office, Bournemouth.*

977 1896. June. *Fricker, James Percy, 24, *St. James Road, Kingston-on-Thames.*

974 1896. June. Gillham, Thomas, 211, *High Street, Kensington, W.*

945 1896. June. *Gregory, Joseph Dalton, 19, *Greenhill Street, Greenheys, Manchester.*

970 1896. May. ‡Head, Robert Heash, 7, *Upper Baker Street, N.W.*

979 1896. June. *Hopkins, Percy Alfred, 37, *Mortimer Street, W.*

971 1896. May. Hurd, Howard, *Council Offices, Broadstairs, Kent.*

972 1896. May. †Jenkins, William John Pearce, *St. Nicholas Gate, Bodmin.*

980 1896. June. *Kershaw, Robert, 55, *Eaton Rise, Ealing, W.*

967 1896. April. King, Charles, 30, *Gt. James Street, Bedford Row, W.C.*

973 1896. May. Lowcock, Sidney Richard, ASSOC.M.INST.C.E., F.R.MET.SOC., 35, *Waterloo Street, Birmingham.*

981 1896. June. *‡Norris, Joseph Foxley, 13, *Alkham Road, Stoke Newington, N.*

974 1896. May. Symons, William Henry, M.D., D.P.H.OXON. & DURHAM, *Guildhall, Bath.*
982 1896. June. *Taylor, Francis Robert, 16, *Arodene Road, Brixton Hill, S.W.*
983 1896. June. *U'Ren, Harry W., 104, *Elliscombe Road, Old Charlton.*
984 1896. June. *Wiltshier, Archibald, 34, *Watling Street, Canterbury.*

ASSOCIATES (Assoc. San. Inst.)

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

1375 1896. June. ‡Andrew, Walter, 19, *Euston Road, N.W.*
1384 1896. June. ‡Balden, John, M.R.C.V.S., *Bridge Street, Leighton Buzzard.*
1361 1896. May. ‡Bannerman, Kenneth J. L., 5, *Cambridge Lodge Villas, Mare Street, Hackney.*
1337 1896. May. ‡Baron, William, *Preston, Lancashire.*
1355 1896. May. ‡Bastiman, James, 42, *Queen Street, Scarborough, Yorkshire.*
1369 1896. May. ‡Baxter, William, 5, *Florence Road, Stroud Green, N.*
1341 1896. May. ‡Blackburn, Miss Sarah, 41, *Carlton Street, Leeds.*
1334 1896. May. ‡Blockey, John Rhodes, 12, *Quested Terrace, Hackney.*
1306 1896. April. ‡Body, Henry, 129, *Nelson Road, Hornsey, N.*
1353 1896. May. ‡Bourne, Edward, 256, *High Street, Cheltenham.*
1326 1896. May. ‡Bromley, James, *Rothwell Estate Office, Sharples Hall, Bolton.*
1356 1896. May. ‡Callaway, Albert Henry, 20, *Chapel Street, Stratford-on-Avon.*
1385 1896. June. ‡Carey, John George, Junr., *Gloucester House, Datchet.*
1373 1896. May. ‡Challice, George Marks, 69, *Sidwell Street, Exeter.*
1374 1896. May. ‡Clark, William George Johnson, 32, *Bell Street, Wigston Magna, Leicester.*
1309 1896. April. ‡Cocks, George, 28, *Bowes Street, Waterloo, Blyth, Northumberland.*
1 36 1896. May. ‡Collins, Wm. Alex., 13, *Mornington Road, Leytonstone.*
1394 1896. June. ‡Colyer, James, 54, *Victoria Road, New Town, Watford.*
1327 1896. May. ‡Crockwell, George Edward, *Moate Cottage, Westbourne Grove. Ilfracombe.*
1354 1896. May. ‡Cruttenden, Thomas Frank, 211, *London Road, St. Leonards-on-Sea.*
1400 1896. June. ‡Davies, James Thomas, *Little Hulton, Near Bolton.*
1310 1896. April. ‡Dawkins, Frank, 39, *Cromwell Road, Fitzhugh, Southampton.*
1398 1896. June. ‡Day, John Francis, 45, *Green Lane, Kettering.*

1404 1896. June. ‡Deeley, George Plant, *Monshall, Amblecote, Brierley Hill, Staffs.*
1362 1896. May. ‡Dowzard, Richard, 30, *The Willows, Liverpool.*
1311 1896. April. ‡Dunmore, Frank Thomas, 32, *Broadway, Crouch End, N.*
1364 1896. May. ‡Duro, Joseph Baker, 2, *Hope Street, Graham Street, Ilkeston.*
1312 1896. April. ‡Dutch, Arthur George, 19, *Westmuir Street, Parkhead, Glasgow.*
1304 1896. May. ‡Elliot, Edward, 37, *Ethelbert Road, Margate.*
1372 1896. May. ‡Elliott, Miss Annie, 50, *Hardshaw Street, St. Helens, Lancashire.*
1363 1896. May. ‡Featherstone, Harold E., *Borough Engineer's Office, Chesterfield.*
1316 1896. May. ‡Foot, Jethro Lovell, 39, *Forster Road, Bevois Mount, Southampton.*
1387 1896. June. ‡Gander, Charles, *Alcester, Warwick.*
1403 1896. June. ‡Gardiner, Miss Blanche, 11, *Victoria Road, Leicester.*
1317 1896. April. ‡Harris, Frank, *Bidborough, Tunbridge Wells.*
1401 1896. June. ‡Hawkins, Walter, 66, *Grosvenor Terrace, Camberwell Road, S.E.*
1323 1896. May. ‡Hibberd, Walter M., 107, *Derby Road, Southampton.*
1347 1896. May. ‡Hickton, John Harry, *Bridge Street, Walsall, Staffordshire.*
1361 1896. May. ‡High, George Frederick, 35, *Clapton Square, N.E.*
1366 1896. May. ‡Henwood, J. H., 40, *Ecclesbourne Road, Thornton Heath.*
1322 1896. May. ‡Horey, Frederick William, 26, *Jerningham Road, New Cross, S.E.*
1370 1896. May. ‡Howard, James Bailey, 56, *Mount Street, Sheffield, Yorkshire.*
1339 1896. May. ‡Jackson, Henry James, *Rye Road, Hoddesdon, Hertfordshire.*
1352 1896. May. ‡Jackson, James, *Town Hall, Huddersfield, Yorkshire.*
1336 1896. May. ‡Jaques, Henry Lea, *Swiss Cottage, Brough, Yorkshire.*
1330 1896. May. ‡Jepson, Kay, 23, *London Terrace, Darwen.*
1397 1896. June. ‡Jones, Mrs. Sarah Ann, 19, *Cavendish Road, Harringay, N.*
1393 1896. June. ‡Keene, Frederick Charles, *Ardenville, Winton, Bournemouth.*
1396 1896. June. ‡Lake, Richard, *Sidmouth, Devon.*
1358 1896. May. ‡Lambert, Wm. John, 18, *Henrietta Street, Swansea.*
1315 1896. May. ‡Larard, Samuel, 38, *Dunkeld Street, Poplar, E.*
1340 1896. May. ‡Lawson, Robert, 133, *Stephens Green, Dublin.*
1320 1896. May. ‡Lee, Sidney George Edwin, 32, *Vale Terrace, Lymington Road, Torquay.*
1394 1896. June. ‡Long, Samuel, 66, *Grosvenor Terrace, Camberwell, S.E.*

1378 1896. June. ‡Lupton, John Richard, *New Park, Harrogate, Yorks.*

1367 1896. May. ‡Matthews, Demas Walter, 133, *Gladstone Avenue, Wood Green, N.*

1371 1896. May. ‡Metzler, George Romeo, 37, *Redesdale Street, Chelsea.*

1312 1896. May. ‡Miller, Wright, 10, *Fowler Street, Breck Road, Everton, Liverpool.*

1379 1896. June. ‡Miners, Richard E., *Board of Works*, 117, *High Street, Poplar, E.*

1313 1896. April. ‡Moss, William, 23, *Wesley Street, Failsworth, Lancs.*

1343 1896. May. ‡Nesfield, W., *Ellerton Road, Surbiton.*

1389 1896. June. ‡Nichol, Frank, 135, *Newington Butts, S.E.*

1323 1896. May. ‡Nuttall, Albert, 13, *St. Chads Road, South Shore, Blackpool.*

1402 1896. June. ‡Nye, Albert William, 34, *Duke Street, Brighton.*

1328 1896. May. ‡Openshaw, John, 46, *Strawberry Hill, Pendleton, Lancashire.*

1314 1896. April. ‡Outhett, Christopher, 92, *Leeds Road, Nelson, Lancs.*

1390 1896. June. ‡Patching, George Cannon, 31, *St. John's Road, Faversham.*

1331 1896. May. ‡Pearce, Samuel George, 14, *Grenville Road North, Plymouth.*

1324 1896. May. ‡Pearce, Thomas, 61, *Grenville Road, St. Jude's, Plymouth.*

1393 1896. June. ‡Petty, Miss Rose Frances, *Nursing Home, London Hospital, Whitechapel.*

1377 1896. June. ‡Peake, Wm. Altree, *Cannock, Staffs.*

1350 1896. May. ‡Pool, Fred, 44, *Shear Brow, Blackburn, Lancashire.*

1335 1896. May. ‡Pover, Edwin, Jun., *Faversham.*

1316 1896. April. ‡Pratley, Frank Augustus, *Highway Department, Central Depôt, Cheltenham.*

1349 1896. May. ‡Price, John, *Newcastle-under-Lyme.*

1374 1896. June. ‡Rance, John Walter, 1, *Homestead Villas, Rivesdale Road, Plumstead, S.E.*

1396 1896. June. ‡Rhodes, George, 32, *Osborne Road, Thornton Heath Surrey.*

1315 1896. April. ‡Ridley, John, 4, *College Street North, Shaw Street, Liverpool.*

1357 1896. May. ‡Roberts, David, *Paddock Villas, Station Street, Ashbourne, Derbyshire.*

1340 1896. June. ‡Safford, Miss Ada Josephine, 34, *Cedars Road, Clapham Common, S.W.*

1391 1896. June. ‡Scott, Robert, 15, *Guy's Terrace, Colonial St., Hull.*

1341 1896. June. ‡Shaw, Joseph Henry, *Brownhills, near Walsall.*

1363 1896. May. ‡Snowden, Thomas, 6, *Spring Bank West, Hull, Yorkshire.*

346 1896. May. ‡Starkey, Horace Joseph Alfred, *Crescent Road, Willenhall, Staffordshire.*

1399 1896. June. ‡Storer, Wm. James, 63, *Manor Street, Clapham, S.W.*
1332 1896. May. ‡Suttle, Charles, *Church Lane, Chislehurst, Kent.*
1323 1896. May. ‡Teek, Henry Matthew, *Axbridge R.S.O., Weston-super-Mare.*
1342 1896. June. ‡Thompson, Frank, 44, *Chattaway Street, Nechells, Birmingham.*
1392 1896. June. ‡Vines, Miss Mabel Mary, 188, *Adelaide Road, Brockley, S.E.*
1363 1896. June. ‡Walker, Herbert, 35, *Shireland Road, Smethwick, Staffordshire.*
1321 1896. May. ‡Walker, William Snowball, 153, *Hither Green Lane, Lewisham, S.E.*
1333 1896. May. ‡West, John, 133, *Leathwaite Road, Clapham Common, S.W.*
1360 1896. May. ‡Wilson, James, *Powderham, Kenton, Devon.*
1316 1896. April. ‡Wood, Edwin Samuel, 15, *Oriel Road, Homerton, N.E.*
1344 1896. May. ‡Wood, Harry, *West London District School, Ashford, Near Staines.*
1319 1896. April. Woodhouse, Thomas, *Accrington, Lancashire.*
1359 1896. May. ‡Yeo, William, *Court House, Marylebone, W.*

OBITUARY.

Sir JOHN RUSSELL REYNOLDS, Bart., M.D., F.R.S.

(VICE-PRESIDENT.)

By the death of Sir J. Russell Reynolds, The Sanitary Institute loses a distinguished Vice-President, and the profession of medicine one of its greatest ornaments. It is not necessary in this place to give a very lengthy account of Sir Russell Reynolds' life nor to attempt a critical appreciation of his services to the science and art of medicine. Those who wish for more details than are furnished in this notice will find them in the "Lancet" and "British Medical Journal" for June 6th, 1896.

Dr. Reynolds was born in 1828 at Romsey, in Hampshire, studied medicine at University College, London, took his degree at the University of London with the highest honours, and after practising for a few years in Leeds returned to London and ultimately became a member of the staff of his Alma Mater in 1859. At University College, Reynolds was Professor of Medicine and also Holme Professer of Clinical Medicine, and on his resignation in 1878 was appointed

Emeritus Professor and Consulting Physician to the Hospital. University College thus honoured its former Student and Professor to the maximum extent possible, and the profession at large did itself honour by honouring Sir Russell Reynolds, who ultimately became President of the Royal College of Physicians, President of the British Medical Association, and Physician in Ordinary to the Royal Household.

Sir Russell Reynolds was never very closely or professionally connected with the science of Hygiene, but like every physician of wide sympathies he fully appreciated the importance of Preventive Medicine. Among his fellow students at University College was Edmund Alexander Parkes, between whom and Russell Reynolds there arose a close and intimate friendship, which lasted until the lamented death of the former in 1876. This friendship was full of honour to both concerned. Reynolds was among those who strove to alleviate the sufferings of Parkes in his last illness, and the mere mention of his deceased friend was always enough to kindle a genuine glow of admiration in Reynolds, who always spoke of him as one of the noblest and best of men. When, therefore, in 1876 it was suggested to establish the Parkes Museum as a memorial to the great English Pioneer of Hygiene, the movement found in Reynolds a staunch and unwavering supporter. In a country like this, where, happily, voluntary effort takes the place of State aid, it is not without strenuous effort that new movements are successfully kept in motion, and no one knows better than the writer of this notice the incessant labour required to keep the Parkes Museum afloat in its early days. Sir Russell Reynolds was a member of the Council of the Parkes Museum from its first formation, and he was always ready, by advice and more material aid, to assist in the firm establishment of the memorial to his deceased friend.

The writer, who was a pupil of Reynolds' at University College, enjoyed the privilege of being on terms of exceptional intimacy with him to the last, and he can assure the readers of this Journal that the Parkes Museum, which was fused in the Sanitary Institute in 1888, owed its success in no small measure to the encouragement which Russell Reynolds ever gave to those who were mainly concerned in furthering its interests.

Sir Russell Reynolds was President of the Section of Sanitary Science and Preventive Medicine at the Congress of the Institute held in Bolton in 1887; and in 1895 he was elected Vice President of the Institute.

Sir Russell Reynolds died in London on May 29th, 1896, and was buried at Owlpen, Gloucestershire. He was twice married but left no issue.

G. V. P.

EXHIBITS ADDED TO THE MUSEUM.

APRIL—JUNE, 1895.

DIVISION A.

Science in Relation to Hygiene.

Tongue of Horse. Illustrating the physiological structure.

Horse Flesh. Specimen of the flesh of horse, showing the texture of lean tissue and the yellowness of the fat.

Ankylosis. Specimen of the Vertebræ of Horse, showing the enlargement and ossification of the joints.

Bruising. Specimen of pork showing the external and sub-cutaneous appearance of an extensive bruise.

Tuberculosis. Inguinal gland of cow congested.

Tuberculosis. Muscular tissue of cow affected.

Swine Fever. Two kidneys affected by the disease.

Swine Fever. Glands of pigs suffering from the disease.

Note. The above specimens were exhibited, with a number of larger ones, at the Special Demonstration on the subject of Diseased Meat, arranged by the Institute as part of the Course for Sanitary Inspectors.

DIVISION B.

Hygiene of Special Classes, Trades, and Professions.

Silicate Cotton. Specimen of this material applied to the protection of a water-supply pipe from frost. *F. Jones & Co.*

DIVISION C.

Construction and Sanitary Apparatus.

Iron Trap. One of two specimens (removed from a large house in London), both of which had been rendered defective by holes punctured through on the sewer side of water-seals after the trap had been supplied by the makers. *Dr. L. C. Parkes.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY

FROM APRIL TO JUNE, 1896, INCLUSIVE.

⁂ *For publications of Societies and Institutions, &c., see under "Academies."*

ACADEMIES (AMERICAN).

Philadelphia. *American Climatological Association.* Transactions for the year 1895. Vol. XI., containing Part I. of the Report of the Committee on Health Resorts, and a general Index of Vols. I.—XI. 293 pp., 8vo. Philadelphia, 1895. *The Association.*

——— *College of Physicians.* Transactions. Third Series, Vol. XVII. Bound with volume is the Jenk's Prize Essay on Infantile Mortality during Childbirth, and its Prevention, by A. Brothers, B.S., M.D. 350 pp., 8vo. Philadelphia, 1895. *The College.*

ACADEMIES (BRITISH).

Liverpool. *Sanitary Inspectors' Association (North Western District).* Ninth Annual Report, 1895-96. 18 pp., 8vo. Liverpool, 1896. *The Association.*

London. *Mansion House Council on the Dwellings of the Poor.* Report for the year ending December 31st, 1895. 86 pp., 8vo. London, 1896. *The Council.*

——— *Society of Engineers.* Transactions for 1895 and General Index, 1857 to 1895. 303 pp., 8vo. London and New York, 1896. *The Society.*

——— *St. Thomas's Hospital.* Reports, New Series. Vol. XXIII. 634 pp., 8vo. London, 1896. *The Secretary.*

——— *The Institution of Civil Engineers.* Minutes of Proceedings, with other selected and abstracted papers. Vol. CXXIII. 595 pp., 8vo. London, 1896. *The Institution.*

Newcastle-upon-Tyne. *North of England Institute of Mining and Mechanical Engineers.* Report of the Proceedings of the Flameless Explosives Committee. Part III. 53 pp., 8vo. Newcastle-upon-Tyne, 1896. *The Institute.*

Abraham, *May E., and* **Davies,** *Arthur Llewellyn, Barrister-at-Law.* The Law Relating to Factories and Workshops (including Laundries and Docks). 283 pp., 8vo. London, 1896. *Miss M. E. Abraham.*

Beach, *Fletcher, M.B., F.R.C.P.* The Treatment and Education of Mentally Feeble Children. 32 pp., 8vo. London, 1895. *The Author.*

Black, *W. G., F.R.C.S.E., F.R.Met.Soc.* Meteorology—Sea-side, English Channel—Winter. 11 pp., 8vo. Reprint from Transactions of the Royal Scottish Society of Arts, 1893. *The Author.*

Blyth, *A. Wynter, M.R.C.S., F.I.C., F.C.S., Barrister-at-Law.* Foods: their Composition and Analysis. A Manual for the use of Analytical Chemists and others, with an Introductory Essay on the History of Adulteration. 735 pp., 8vo. 4th Edit. London, 1896. *The Author.*

Board of Agriculture. The Cockchafer. 3 pp., 8vo. London, 1896. *The Board.*

— — — Agricultural Returns for Great Britain. Showing the acreage and produce of crops, prices of corn and number of live stock, with Agricultural Statistics for the United Kingdom, British possessions and foreign countries, 1895. 248 pp., 8vo. London, 1896. *The Board.*

Butler, *David B., Assoc.M.Inst.C.E.* Portland Cement: some points in its testing, uses and abuses. 31 pp., 8vo. Excerpt Trans. of Society of Engineers. London, 1896. *The Author.*

Collingridge, *W., M.A., M.D.* Practical Points on the Hygiene of Ships and Quarantine. 43 pp., 8vo. Course of papers (No. 33), Shipmasters' Society. London, 1894. *Shipmasters' Society.*

Committee on the Mental and Physical Condition of Children. Report on the Scientific Study of the Mental and Physical Conditions of Childhood, with particular reference to Children of Defective Constitution; and with Recommendations as to Education and Training. 117 pp., 8vo. London, 1895. *The Committee.*

Croydon Corporation. Report of the Hospital Department for the official year ended 31st March, 1895, including a Medical Report of the cases. 49 pp., 8vo. Croydon, 1895. *Prof. W. H. Corfield, M.A., M.D.(Oxon.)*

Domestic Economy (Longmans' Reader). 200 pp., 8vo. London, 1895. *Miss M. Keay.*

Froud, *A. G., Lieut. R.N.R.* Heating of Ships and Cargoes—Waste of Heat in Steamers. 30 pp., 8vo. Course of Papers (No. 15), Shipmasters' Society. London, 1891. *Shipmasters' Society.*

Greenwich Royal Observatory. Reduction of Greenwich Meteorological Observations. Part III. Temperature of the Air as determined from the observations and records of 50 years, made at the Royal Observatory, Greenwich. Fol. London, 1895. *Astronomer Royal.*

Griffiths, *F., M.D.* Report on the condition of the Porter Brook, Sheffield. 12 pp., 8vo. Sheffield, 1876. *Prof. W. H. Corfield, M.A., M.D.(Oxon.)*

Hart, *John W.* Hints to Plumbers on Joint Wiping, Pipe Bending, and Lead Burning. Second Edition. 311 pp., 8vo. London, 1896. *The Author.*

Jacobi, *A., M.D.* Nephritis of the Newly Born. 26 pp., 8vo. Reprint from the "New York Medical Journal," January 18th, 1896. *The Author.*

Kenwood, *Henry R., M.B., D.P.H.* Public Health Laboratory Work. Second Edition. 453 pp., 8vo. London, 1896. *The Author.*

Leeds Sanitary Aid Society. Annual Report for 1895. 11 pp., 8vo. Leeds, 1896. *The Society.*

Leffmann, *Henry, M.D., Ph.D.* Examination of Water for Sanitary and Technic purposes. 154 pp., 8vo. Philadelphia, 1896. *Blakiston, Son & Co.*

Leffmann, *Henry, M.D., Ph.D., and* **Beam,** *William, M.A., M.D.* Analysis of Milk and Milk Products. 92 pp., 8vo. Philadelphia, 1893. *Blakiston, Son & Co.*

Local Government Board. Dr. W. W. E. Fletcher's Report on the Sanitary circumstances of the Brecknock Rural District. 8 pp., fol. London, 1896.

——— Dr. R. Bruce Low's Report on an outbreak of Enteric Fever at Helmsley, in the Helmsley Rural District, North Riding of Yorkshire. 20 pp., fol. London, 1896.

——— Dr. R. J. Reece's Report on the Sanitary condition of the Borough of Pembroke. 14 pp., fol. London, 1896.

——— Dr. R. Bruce Low's Report on the Arrangements made by the Urban District Council of Sevenoaks for the Isolation of Infectious Diseases. 5 pp., f.cap. London, 1896.

——— Dr. S. Monckton Copeman's Report on an outbreak of Epidemic Skin Disease in the Enfield Workhouse of the Edmonton Union. 7 pp., f.cap. London, 1896.

——— Dr. G. S. Buchanan's Report on the Sanitary Condition of the County Borough of West Bromwich, and on prevalence of Enteric Fever there. 11 pp., fol. London, 1896.

——— Dr. R. Bruce Low's Report on the Sanitary Circumstances of the Borough of Cowbridge, and upon Administration by the Town Council. 10 pp., fol. London, 1896.

——— Report of Dr. H. Timbrell Bulstrode upon the Sanitary State of the Village of Potterbury, and upon an Outbreak of Enteric Fever in the locality. 5 pp., fol. London, 1896.

——— Inquiry into the alleged Failure of the East London Water Supply in the Summer of 1895. 17 pp., fol. London, 1895. *R. Thorne Thorne, C.B., F.R.S.*

——— Inquiry directed by the, under Section 19 of the Metropolis Water Act, 1871—Minutes of Proceedings. 389 pp., fol. London, 1895. *London County Council.*

——— Report of Col. Ducat on the Application to the Board on behalf of the London County Council, to alter and amend and add to certain of the Regulations made by the Water Companies of London, under the Metropolis Water Act. 1871, 20 pp., fol. London, 1895. *Major Hector Tulloch, C.B., R.E.*

——— Extracts from the Annual Reports of, for 1893-94, 1894-95, relating to the Sale of Food and Drugs Acts. 47 pp.; 23 pp., 8vo. London, 1894; 1895. *Prof. W. H. Corfield, M.A., M.D.(Oxon.)*

Louisiana Board of Health. Annual Report, 1873. 203 pp., 8vo. New Orleans, 1874. *Prof. W. H. Corfield, M.A., M.D.*

Maguire, Wm. R. Domestic Sanitary Drainage and Plumbing. Lectures on Practical Sanitation, delivered to Plumbers, Engineers and others. 475 pp., 8vo. London, 1896 Edition.
The Author.

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Ashwell & Melbourn, 1895	*Bushell Anningson, M.A., M.D.*
Bedfordshire C.C., 1894	*Prof. W. H. Corfield, M.A., M.D.(Oxon)*
Birmingham, 1895	*Alfred Hill, M.D., F.R.S.E.*
Birmingham, Quarter ending Jan. 1st, 1887	*Prof. W. H. Corfield, M.A., M.D.(Oxon)*
Bournemouth, 1895	*P. W. G. Nunn, M.R.C.S.*
Bridlington, U.D.C., 1895	*Wm. A. Wetwan, M.R.C.S.*
Bridlington, R.D.C., 1895	*Do.*
Cambridge, 1895	*Bushell Anningson, M.A., M.D.*
Castle Bromwich R.D., 1895	*A. Bostock Hill, M.D., D.P.H.*
Chelsea, 1894	*Prof. W. H. Corfield, M.A., M.D.(Oxon)*
Chesterton, 1895	*Bushell Anningson, M.A., M.D.*
Do. **(Rural)**, 1895	*Do.*
Croydon Rural, 1895	*L. W. Darra Mair, M.D., D.P.H.*
Darwen, 1895	*F. G. Haworth, D.P.H.*
Dublin, 1894	*Sir C. A. Cameron.*
Ely (Rural), 1895	*Bushell Anningson, M.A., M.D.*
Erdington, 1895	*A. Bostock Hill, M.D., D.P.H.*
Exeter, 1895	*J. Woodman, M.D., F.R.C.S.*
Finchley, 1895	*H. R. Kenwood, M.B., D.P.H.*
Hackney, 1895	*J. King Warry, M.D., D.P.H.*
Hastings, 1895	*The Town Clerk.*
Hull & Goole Port, 1895 (January & February) 1896	*W. H. Crane.*
Islington (St. Mary), Monthly Reports, 1871 & 1872, Second & Third quarters, 1895, and for the Year 1894	*Prof. W. H. Corfield, M.A., M.D.(Oxon)*
Kensington, 1870	*Do.*
Lancaster, 1894, 1895	*G. R. Parker.*
Leicester, 1871	*Prof. W. H. Corfield, M.A., M.D.(Oxon)*
Llandaff & Dinas Powis, 1895	*Richard Prichard, M.D.*
Llandilo-Talybont, 1895	*Trafford Mitchell, M.D.*
London (City of), 1894	*Prof. W. H. Corfield, M.A., M.D.(Oxon)*
Maidstone (Sanitary Inspector) 1895	*W. Jackling.*
Margate, 1876	*Prof. W. H. Corfield, M.A., M.D.(Oxon)*
New Windsor, 1895	*Edward Casey, M.D.*

Richmond, 1894 ..	.. *Prof. W. H. Corfield, M.A., M.D.(Oxon)*
Roxburgh County (Sanitary Inspector), 1895 ..	.. *Adam Morris.*
Scarborough, 1895 ..	.. *J. Bastiman.*
Southampton, 1894 ..	.. *Wm. Whitaker, B.A., F.R.S.*
St. George-the-Martyr, Southwark, 1894 ..	.. *Prof. W. H. Corfield, M.A., M.D.(Oxon)*
St. Ives (Hunts) & Swavesey, 1895	.. *Bushell Anningson, M.A., M.D.*
St. Mary, Islington, Fourth quarter, 1895 ..	.. *Prof. W. H. Corfield, M.A., M.D.(Oxon.)*
St. Mary, Stoke Newington, 1895	.. *H. R. Kenwood, M.B., D.P.H.*
St. Marylebone, 1895	.. *Prof. W. H. Corfield, M.A., M.D.(Oxon)*
Sutton Coldfield, 1895	.. *A. Bostock Hill, M.D., D.P.H.*
Tonbridge, 1895 ..	.. *J. Scott Tew, M.D., D.P.H.*
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NOTES ON LEGISLATION AND LAW CASES.

Prepared by A. Wynter Blyth, Barrister-at-Law.

Before Lord Justices Lindley and Kay.

HEWITT *v.* TAYLOR.

(74 *L. T. R.* 51.)

Under Sect. 21 *of the Sale of Food and Drugs Act* (38 *and* 39 *Vict. c.* 63) *the certificate of the analyst is not conclusive evidence but only evidence on which the Justices may regard the facts therein stated as proved unless there is other evidence to show that they are erroneous.*

This was a case stated by the Justices of the Borough of Mossley. The Appellant purchased a pint of milk from the Respondent Taylor, and complying with all the procedure laid down by the Act transmitted it for analysis to the public analyst, and in due course received a certificate to the effect that it had been adulterated by the addition of over 6 per cent. of water.

At the hearing the Respondent tendered himself as a witness and gave evidence. He stated that on the day of the purchase of the sample of milk by the Appellant the milk of two cows was put into a can from which the purchase was made, that there was no water in the can when he began to milk the cows, that he milked them himself, that he added no water afterwards, and that no person but himself had control of the can from the time the milk was put therein to the time of the sale to the Appellant. He further stated that one of the two cows referred to had calved on the 9th of April, 1895, and that for some time subsequent, prior to the 26th of April, he noticed that the milk was of poor quality.

One of the Justices hearing the case, formerly owned the cow, and knew that the particular cow did give milk of poor quality.

The Justices dismissed the summons.

Lord Justice Lindley in the course of his judgment stated that although there was a little ambiguity about the expression used in the Section "shall be sufficient evidence" the section does not say "conclusive evidence." It certainly could not mean to make the certificate conclusive evidence because after stating that the certificate shall be sufficient evidence of the facts therein stated, it goes on to say "unless the Defendant shall require that the analyst shall be called as a witness." That the Respondent did not do. Then the Section proceeds "and the parts of the articles retained by the person who purchased the articles shall be produced and the Defendant may if he think fit tender himself and his wife to be examined on his behalf and he or she shall if he so desire be examined accordingly." The Defendant may be examined, for what purpose? to show of course that there was a mistake and that the certificate was inaccurate. If this were not so there would be no possible object in the last clause of the Section. The Section means that the Justices may act on the certificate, but they are also bound to weigh any evidence offered on the other side, and come to a conclusion upon the whole evidence given by both sides. The appeal must be dismissed.

Lord Justice Kay concurred. Appeal dismissed.

QUEEN'S BENCH DIVISION.

Vestry of St. Leonards, Shoreditch v. Phelan.

(74 *L.T.R., n.s.* 285).

Once a drainage pipe becomes a sewer within Sec. 250 *Met. Man. Act,* 1855, *by reason of it being combined with the drainage of other houses it still continues to be a sewer although the pipe afterwards only drains one house.*

This was an appeal by the Shoreditch Vestry against a magisterial decision dismissing a summons taken out under the Public Health (London) Act, 1891, against Mrs. Phelan asking for an order of abatement as to a nuisance arising from defective drainage, 42, Westmoreland Place. The premises in question were drained by a drain common to that house and premises at the back, 36, Nile Street. The owner of 36, Nile Street was also served with notice, and at once complied with the notice by carrying a separate new drain into the sewer; hence when this drain was completed 42, Westmoreland Place ceased to be drained by a combined drain, whereupon a fresh notice was served upon the owner of 42, Westmoreland Place, but the owner refused on the ground that it was still a sewer and a summons being issued and heard, the magistrate dismissed the summons.

The Vestry appealed.

For the appellants **Lawson Walton**, Q.C., argued that the magistrate was bound to regard merely the nature of the pipe at the time the summons was issued and that he has no right to examine into the history of the pipe, hence, if at the date of the summons it answers to the description of a drain under Sec. 250 Met. Man. Act, 1855, he must hold it to be a drain and therefore repairable by the owner of the premises it drains.

Mr. Rowlett for the respondent argued that once a drain becomes sewer it remains a sewer.

Justice Day: This appeal must be dismissed. It appears clearly on the evidence which was given before the magistrate that at one time the pipe in question drained two houses. There is not a particle of evidence that it was ever sanctioned by the local authorities as what is called a combined drain. A pipe taking away drainage from two houses is a sewer, and so it is clear that this pipe was once a sewer. Being a sewer the duty on the parish was to keep it in repair. This duty was not discharged. Accordingly there was a complaint that the pipe caused a nuisance. Upon this the Vestry tried to get an abatement. An arrangement was made that the owner of the other house should discharge his drainage in another way. When his drainage was cut off then the pipe drained only No. 42, Westmoreland Place. Thereupon the parish authorities said this is no longer a sewer repairable by us: it is a drain and the owner of it must repair it. The magistrate very properly decides against the parish. The nuisance was a nuisance caused by the parish. This alone was sufficient to justify his decision. But there is a broader ground. As Mr. Walton has expressed it, that ground is, that once a drain is a sewer it is always a sewer. I do not say that, but I do say that once it is a sewer, it remains a sewer so long as it is used for drainage. It does not cease to be a sewer because the owner of the other house chooses to cease to drain through it.

Justice Wills concurred. Appeal dismissed.

COUNTY OF LONDON SESSIONS.

Before the Common Serjeant.

Unsound Sausage Meat.—John Harrington, a meat salesman, of 99, Charterhouse Street, E.C., surrendered to his bail on an indictment charging him with selling the carcass of a cow which was unfit for the food of man.

The prosecution was undertaken by the Poplar District Board of Works.

On the 5th of December last a man named Robinson, a sausage-maker in the East-end of London, was found to be in possession of the carcass in question, it being absolutely unfit for human food. That person was tried and convicted at the Worship Street Police Court, and ordered to pay the maximum penalty, viz., £50. Then the Sanitary Authorities endeavoured to trace whence the meat had come, and it was discovered that Harrington had sold the meat to Robinson. In the first instance the cow was in the possession of a farmer of Glastonbury, Somerset. It suffered from a wasting disease, and had to be killed, and the carcass was sold for 7s. The animal was afterwards despatched by the London and South Western Railway to Harrington, and was labelled "cats'-meat," and was delivered at the prisoner's premises with that label attached.

Witnesses having given evidence for the prosecution, Sir Forrest Fulton intimated to Mr. Geoghegan his opinion on the law. Thereupon Counsel conferred with client, the result being that Harrington withdrew his original plea and pleaded guilty.

The Jury returned a formal verdict of guilty.

SIR F. FULTON: May I inquire for my own information whether any of this meat was made into sausages?

Mr. MUIR: It was in the act of being cut up when the Sanitary Inspector entered. If he had been half an hour later, no doubt the cow would have been made into sausages.

Mr. GEOGHEGAN appealed to his Lordship to deal with the case as an isolated transaction.

The COMMON SERJEANT said the case was a very bad one, and ordered the prisoner to be imprisoned and kept to hard labour for three months.

GENERAL NOTES.

SIR THOMAS CRAWFORD.—At the Annual Meeting of those interested in the Royal School for Officers' Daughters, Bath, held at the Royal United Services Institution, a tribute of great respect to the memory of the late Sir Thomas Crawford, K.C.B., was paid by H.R.H. The Duke of Cambridge. He said, in referring to Sir Thomas, that he had "lost a great friend and one he had highly prized."—*British Medical Journal*, May 9th, 1896.

VACCINATION.—Attention has been called to the serious local epidemics of small-pox that have occurred recently in various parts of the country, and to the difficulties that have arisen owing to the division of control between the Sanitary Authorities and the Poor Law Guardians in the Prevention of the spread of the disease. The various means for coping with the disease, and for stamping it out, should be in the hands of Sanitary Authorities. The Sanitary Authorities have the control of every means for the prevention of small-pox except that of vaccination, and this means of prevention should be placed under their jurisdiction. The transfer of this duty from the Boards of Guardians to the Sanitary Authorities would place the whole of the machinery for the prevention of the disease under one organisation, the relative parts of which could be mutually adapted to suppress smoothly and expeditiously any appearance of epidemic.

If vaccination were in the hands of the Sanitary Authorities, it would obviate much misunderstanding, especially at the most serious and important time of an outbreak of small-pox, when the means of suppression being in the hands of two authorities in the same locality leads to much confusion, counter-proposal, and delay.

The responsibility not only for stemming an immediate outbreak, but also preventing a future outbreak, should be placed upon the Sanitary Authority. Accusations on the one hand that it is due to the insufficient provision of hospital accommodation, and on the other that it is due to insufficient vaccination, could not then be made by one public body against another.

The Sanitary Authorities have notified to them all cases of small-pox, and consequently are immediateiy acquainted with the extent and locality of outbreaks, and know when and where vaccination is most urgent. In case of an outbreak, it falls upon these authorities to receive the notifications, to provide for isolation and disinfection, and, in short, to undertake the whole duty of combating the disease; and in case of inability to cope with it the odium falls upon them. The transfer of the control of vaccination need not make any difference in the cost, as the same officers would carry out the work, but it would make a vast improvement in the administration, inasmuch as it would be worked as part of one public department.

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JOURNAL
OF
THE SANITARY INSTITUTE.

CONGRESS AT NEWCASTLE-UPON-TYNE.

INAUGURAL ADDRESS,

BY THE RIGHT HON. THE EARL PERCY,
P.C., D.L., J.P.,

Delivered September 2nd, 1896,

H.R.H. THE DUKE OF CAMBRIDGE, K.G., PRESIDENT OF THE INSTITUTE, IN THE CHAIR.

THE compliment paid me by the Council of the Sanitary Institute in placing me in the Presidential Chair on the occasion of the meeting of the Congress in this ancient city is one I feel very highly, as well as the privilege it confers upon me of addressing you to-night. It is the more grateful to me because the Duke of Northumberland has always taken a keen interest in the work of the Institute. He took part in its inauguration, and was its first President; a position he occupied for several years. I am sensible of one difficulty, however, experienced perhaps by others to some, although not to an equal extent, on similar occasions. I, who am no expert, am called upon to address an audience largely composed of those who have chosen sanitary questions for their peculiar study, and of whom many have made a distinguished mark in the pursuit of those inquiries to which they have devoted their time and attention. I am therefore on the horns of a dilemma. I must either confine myself to vapid generalities well calculated to weary a trained and intelligent listener, or I must lay myself open to the charge of being one of those who rush in where angels fear to tread, and deal with subjects about which my hearers not only know more than I do, but must infallibly discover before many minutes are over by what extremely narrow limits the little knowledge I possess is bounded.

I can at any rate, however, utter one sentiment which cannot be considered either a platitude or an error when I express the great pleasure the visit of this Society has conferred upon the residents in this county and city (especially since they are honoured by the presence of the illustrious Duke who so ably discharges the duties of President), and the respectful but hearty welcome they desire to be permitted to extend to His Royal Highness, and to the members generally. Since its foundation twenty years ago the Institute has held fourteen congresses in various great centres of the United Kingdom, but I believe Newcastle is the first spot that has had the distinction conferred upon it of a second visit. I trust that from this fact I may be allowed to draw the inference that the reception the members of this Association met with in 1882 has been the source of the same agreeable recollections in their minds as those with which it is associated in ours, and it will be interesting to all who live in Northumberland to gather your impression of the progress made in this locality in the interval in carrying out the principles and the work you have so efficiently and unremittingly taught and fostered, though I fear that you will note much yet requiring to be done before the district can be thought to approach the ideal of the sanitary reformer.

From a hygienic point of view Northumberland presents some peculiarly interesting features, not perhaps often associated in a similar degree within an equal area. On the one hand we have a large extent of country somewhat thinly inhabited, and with, I am sorry to say, a steadily decreasing population. Every township in the strictly rural portion of the County showed a decrease in the number of its inhabitants at the last census. This is not the proper place to inquire what may be the cause (or rather causes, for there are certainly several), conducing to this result. It is a phenomenon prevalent, not only throughout the United Kingdom, but apparently observable in most, if not in all, the civilized communities of the world; and I will only venture to say that, whatever truth there may be in the many theories formed to account for it, none of them seem to be either singly or collectively adequate for the purpose. I am not aware that Northumberland suffers more from this rural exodus than other parts of England, but the nature of the country over a considerable area is such that its sparsity of population is singularly pronounced. It may surprise you to hear that there is on the borders of Scotland a continuous tract, running from the north to the south of the county, larger than the whole of Suffolk, and more thinly inhabited than any other county in England. And yet the proportion of population to area in the county at large (if for this purpose we may include the City of Newcastle within its limits, though we must not forget that Newcastle has from ancient times been distinguished as having a county of its own) is one to a fraction over two acres and a half. This shows how populous a portion of the county is, and we have therefore on the one hand to face the problems in sanitation presented by crowded areas, and on the other those which meet us in the case of dwellings very isolated, and frequently inaccessible by roads. These last are of course in one sense the least important, if we regard merely the number of persons exposed to danger. It by no means follows, however, that the conditions of the people on the hills and moorlands are not such as to need attention. Their houses are often small and old. The position of the midden, the byre and the sheepfold is determined by chance or apparent convenience, without regard to any other consideration; and I have been assured by medical men that from time to time more persistent and recurring cases of diphtheria have been met with among the families of the hill shepherds than in the lower and more thickly inhabited parts where they might be more naturally expected. It is here that the system of inspection which has been the outcome of that interest taken in recent years in sanitary questions, which the labours of this Institute have done so much to promote, is especially useful, and to it we must look for insuring that while the health of large centres of population, which attract more of the public attention, is cared for, the well-being of those who dwell in more remote districts is not neglected. At the same time it must be remembered that in instances of this description, owing to the difficulties of carriage and of providing accommodation for workmen, any material modification of pre-existing conditions is an arduous and comparatively expensive task.

In the more thickly populated quarters other problems present themselves for solution. So far as the sanitation of the houses themselves is concerned, great theoretical advances have been made, and it is not too much to say that experts have approached very closely to a knowledge of the arrangements universally demanded for securing an absolutely healthy state of things, though the practical obstacles to carrying them out are often very great.

This can hardly be affirmed with reference to the all-important questions of sewage disposal and water supply. With regard to the former, there are so many competing systems, each with its own advocates and detractors, that a Local Authority, finding itself face to face with the obligations imposed upon it by recent legislation, is often at a loss which of the numerous schemes to adopt. The result is that there is frequently considerable delay in commencing reforms urgently needed, and a risk that large sums of money may be expended on works which these authorities have an uncomfortable suspicion may not, after all, fully answer the object in view. It is much to be desired that the principles and practice of sewage disposal should attain more of the status of an exact science than it yet appears to have done. No general system can, of course, be applicable in all cases; indeed, each locality presents features demanding special treatment. But one may hope that the advance of research may ere long render it possible to formulate more closely the essential conditions of the problem, and so to class them that those who are responsible for the health of a neighbourhood, and for the purity of its streams, may have some fair idea of that best suited to their requirements.

But perhaps the problems connected with water supply are even more important and pressing. The population of the country is not only rapidly increasing, but, as I have already said, it is concentrating itself in certain districts. It is possible, no doubt, that social and agricultural changes may arrest the aggregation, although there is as yet little sign of this. So long as the commercial prosperity of the nation continues, it is extremely unlikely that our large towns and cities will cease to expand, although it is within the bounds of possibility that the rate of increase may be reduced. The demand for water consequently needs serious and sustained consideration. Already the east of London is in great straits, owing, it is true, in part to the somewhat unusual climatic conditions lately prevalent. And, to go no further than the place on which we stand, Newcastle itself has experienced some perturbation as to the sufficiency of its supply, and those who are responsible for maintaining it are making great efforts, and expending large sums of money in enlarging their resources. It is unnecessary to refer to the numerous, and, in some cases, gigantic undertakings entered into throughout the length and breadth of the land with the same object. But in spite of the attention paid to the subject, and to the wise vigilance constantly exercised by Parliament, there appears to be a certain want of system which may in the not very distant future lead to serious, if not disastrous, results. The water strictly appertaining to any area is that of the catchment basin of its rivers. Unfortunately, the extent or productiveness of this area is not always commensurate with the number of its inhabitants, and in such cases a supply must be sought in other quarters. Now it should always be remembered that such a proceeding is an act of poaching on our neighbours' preserves. It has been laid down by jurists that in the absence of a poor law, or some other similar provision, a starving man has a natural right to appropriate from any source sufficient for the preservation of existence. Acting on a somewhat similar principle, Parliament has from time to time sanctioned the abstraction of the water supply of one basin for the necessities of another, provided always that enough is left for the present or probable future wants of the former. And it has, of course, unavoidably, still more often admitted the appropriation of the supply arising in a thinly-populated district for the requirements of a denser population within the same watershed. It may be doubted, however, whether, in spite of all the care taken to weigh conflicting claims, and the laudable jealousy evinced to prevent undue depletion in any direction, some more regular effort should not be made to map out the watersheds of England, and to define the area which each centre of population may reckon as its own.

In no part of the country does this matter call more earnestly for attention than Northumberland, and, I might add, Durham. In the south and west of England the lakes of Cumberland and Wales, and the great valleys of the Thames and the Severn present available features, though considerable outlay may be required to make them so. Even in the Midlands the area between the backbone of the country and the sea is sufficient to receive a very considerable rainfall. But as the east and west coasts trend in towards the north the catchment basin is straitened. The rainfall too on the east coast is far less than on the west, and there are very few natural lakes of any size. The drainage area of the basin of the Tyne is considerable, being no less than 1,130 square miles, but those of the Wansback and the Blyth are only 131 and 126 respectively, and in both there is a large and rapidly growing population. Durham, with a population more than double that of Northumberland, has, in addition to her share of the Tyne and Tees, only one river of any importance within her limits. Besides all this the subterranean operations so largely carried on in both countries often unavoidably lead to a diversion of the natural supply, and cause trouble and inconvenience. It is evident that under these circumstances the due apportionment of the stores at command is a matter of the first moment, not only as regards the present, but also with respect to the future.

There is another feature shared by Northumberland in common with many other mining counties, which greatly complicates this and other sanitary enterprises, namely; the shifting of considerable bodies of people within a comparatively small area. In one place a seam of coal is worked out, or some event occurs rendering the further conduct of the industry unremunerative. In another a fresh pit is opened, and a large number of persons are suddenly collected in one spot. This occurs now from time to time, and is likely to happen even more commonly hereafter. For without adopting the more pessimistic estimates sometimes made of the limits of our total remaining available coal measures, or of the dangers from foreign competition, or of the possible effect upon the north of the profitable winning of coal in the south of England, it is certain that some of the older workings in the district are approaching to within measurable distance of exhaustion, and a consequent alteration in the present distribution of the population is inevitable. Great caution is therefore necessary, both in deciding the area to be drawn upon, and the nature, extent and permanence of the means employed for doing so.

It may seem almost frivolous to refer to the bicycle and the auto-motor as likely to have a bearing on sanitary operations, but I believe that a little consideration will show that they may have a material, though probably gradual effect upon the distribution of the people, not to be ignored in view of prospective requirements. There are still certain roads in the country known to the law as main roads as distinguished from highways, but for the last forty years this distinction has been theoretical or administrative rather than essential. Strictly speaking the main roads of a country are the great arterial thoroughfares which carry the bulk of the traffic considerable distances. In this sense railroads have for long been the only real main roads in England. The smaller towns and large villages on the old routes have suffered : the traffic, which under a slower system of locomotion tarried temporarily or permanently with them, has gone past them. On the other hand railways, though they have contributed to swell our large cities, have at the same time to some extent relieved their congestion. Thousands of artizans and others who crowded the towns in the days when their own legs, or possibly an omnibus were the only means at their disposal to enable them to cover the distance between their homes and their workshops, have now been enabled by cheap trains to live at a greater distance from their work, and in a purer atmosphere. But the bicycle and the motocar may do a similar work on a larger scale. The first is, and the second will soon be a far cheaper conveyance than a train, besides offering amenities of which the train cannot boast, especially if, as in London, the journey by rail has to be performed for a considerable distance under ground. For pleasure trips the bicycle is also preferable to the excursion train wherever it is unnecessary to cover great distances or to effect a great economy of time. It seems therefore quite within the bounds of possibility that the traffic on the old main roads may soon be largely increased, and the old inns, and the towns and villages which lie upon them may regain some of the importance they enjoyed in the days of the mail coach. If so, a fresh distribution of the population will assuredly follow, demanding the renewed attention of those whose duty it is to provide for the health of the people, and it is of the highest importance that in striving to meet existing conditions nothing calculated seriously to impede us in adapting ourselves to altered circumstances should be attempted.

Such are some of the inherent difficulties confronting those who are responsible for public sanitation: difficulties which the researches undertaken and the instruction conveyed by members of the Institute assist us in solving. It is to them we must also look for some assurance as to the probable effect which some new departures are calculated to have on health, a matter somewhat disquieting to untrained intelligences. Is it true, as is occasionally affirmed, that the general use of electric light threatens to be prejudicial? The answer is usually in the negative, and we are reminded that there is no reason why, if judiciously handled, this form of illumination should tax our eyesight or our health more heavily than the methods hitherto in use. Theoretically this may be the case, but in practice the amount of light afforded by installations is sensibly in excess of that with which our fathers were contented, a fact which will be patent to anyone, who, after living any length of time in streets or houses where the system is in vogue, returns to gas lamps in the streets, and oil or candles in the house, and there are not wanting those who declare that both their vision and their general condition have already suffered. Is this imagination, or has it at any rate some solid basis?

Again, may we be quite easy about the introduction of wood paving in our large cities? This is not a matter which troubles the minds of Northumbrians, for our local authorities cling in a most conservative spirit to stone and cobble. But as regards the Metropolis there has been no change better calculated to strike the mind of the most casual observer than this. The gain in many way has been enormous. The streets are quieter, the roadway, if renewed with sufficient frequency (a point not always enough attended to), is smoother, and the traction, in dry weather at any rate, is easier. If it is more slippery than stone or Macadam, the consequences to horses of an accident are less serious. It has no doubt other advantages which I need not dilate upon, but certainly under the present system of watering and scavenging it loads the atmosphere with a very large amount of undesirable material. If anyone will look out of their bedroom window in the early hours of a dry summer morning, they may see the sweepers endeavouring to guide the refuse into the side gutters, but raising an almost equal cloud of dust behind it, which is borne along upon the breeze. At such moments the question suggests itself irresistably whether the free and happy microbe is not being carried away also by the same current, to find a shelter where chance may guide or fortune may direct. Nor do its facilities for locomotion entirely disappear with the advance of the day, for it will be observed, that in order to secure a firm footing for the traffic, the water cart for the most part confines its operations to the sides of the roads, and leaves the rubbish in the centre to be raised by every passing vehicle.

It is pre-eminently the part of scientific experience to advise on such topics, and all the more so in the lull that prevails in the tide of Parliamentary action, though indeed these matters are of a kind in which it is difficult for Parliament to intervene effectively.

We appear to have arrived at a period when there is not much to be hoped for in the immediate future from legislation. It has been, I believe, the custom of some of those who have preceded me in the office I hold by your favour to-night to review and to comment on the sanitary legislation of the last session of Parliament. On this occasion that duty is a light one, for the labours of the legislature have not been prolific in this direction. A measure amending the Public Health Acts, and another amending the Labourers Acts, and imposing some fresh duties and conferring some new powers on sanitary Authorities, has indeed been passed for Ireland, but I shall ask you to excuse my making any remarks with regard to them, for I have long ago come to the conclusion that to discuss matters of detail relating to that country with advantage one must be either an Irishman oneself, or at any rate enjoy a much closer acquaintance with it than I do. A measure amending, also in a point of detail, the Housing of the Working Classes Act, so far as it relates to Scotland, almost completes the list; but I must not omit to notice two Public Health Acts, one of which empowers the Local Government Board to extend to port Authorities the provisions of the Infectious Diseases Prevention Act of 1890, and the other finally repeals the antiquated enactments relating to quarantine. The last is noteworthy as closing for ever a chapter in the history of hygienic precautions, and as by implication bearing testimony to the zeal and efficiency of those who have in recent years protected our shores so successfully from the inroads of epidemics. Without their care and skill no regulations, however wisely conceived, could have justified the legislature in abandoning the older practice. Let me add that nowhere has this work been better carried out than on the Tyne. The labour and the responsibility entailed on those who have this charge laid upon them is enormous, and they are entitled to the cordial sympathy and support of all classes of the community.

It is a matter for congratulation that the inquiries of the Royal Commission on vaccination have at length been brought to a close, and it is to be earnestly hoped that they will contribute to the formation of a sounder public opinion than has hitherto prevailed in some quarters upon a subject of such vital moment to the well-being of the people, and perhaps to some further legislative action.

I must, however, repeat my belief that for some little time to come we shall look in vain to Parliament for any very conspicuous sanitary activity. The power to legislate is now almost exclusively in the hands of the administration of the day. Bills introduced by private members very much more rarely escape inanition or massacre than was the case five and twenty years ago. But the measures which ordinarily commend themselves to government officials are those which attract more public attention, and are better adapted for interesting a popular audience than most sanitary questions are. It should not be forgotten, however, that quite apart from the passing of public measures, Parliament is in another direction constantly devoting its attention to providing for the health of the country in the consideration and moulding of the mass of private Acts annually added to the Statute Book, of which probably a majority affect the question directly or indirectly. The aggregate work of Parliamentary Committees is enormous, and has at least as much effect on the welfare of the people as the more ambitious and prominent efforts to which statesmen devote themselves. On the whole I believe it is well done. Indeed, I do not know that so long as it receives proper attention we need very much regret any ebb in the flow of public legislation. I am disposed to agree with the President of your last Congress when he said that administration rather than legislation now demands the energies of the sanitary reformer.

Under the head of administration so much has been done, and the progress made since first this Institute entered upon its career has been so marked that it seems almost ungrateful to comment on any defects which may still exist. In some directions however we move rather slowly. The law now places many obligations on local authorities of a much more drastic character than formerly, and it is not to be wondered at if at times they do not rise very quickly or fully to the occasion. It may be readily admitted that the importance of sanitation is freely recognised by the members of local bodies, and many of them take great personal interest in the matter. But besides the laudable and wholesome fear of the ratepayer constantly present with them, they rarely possess the technical knowledge needed to enable them to form a positive opinion with regard to the competing proposals which are laid before them, and a more or less openly confessed consciousness of this often leads to unnecessary vacillation and delay in carrying out works of pressing importance. And, if I may be permitted again to repeat what I said in an earlier portion of this address, it is here that those who are learned in sanitation can come to their help by defining more closely than has hitherto been done the best means of meeting certain classes of conditions, so that these authorities may more easily ascertain the category under which their own case falls. We should not then witness what not unfrequently takes place now, when two authorities in practically identical circumstances adopt schemes and methods of totally different characters, each condemned by the adherents of the other. Nor would those who devote themselves gratuitously to the public service, who, many of them, have private claims upon them which they postpone to this work, and who are therefore entitled to the fullest consideration, experience that hesitation and perplexity they sometimes suffer from now in endeavouring to meet the exigencies of novel legislation and of a growing population.

There is also a difficulty inherent in all bodies of men who meet for purposes of consultation, and especially if they be elective bodies, which is felt in direct proportion to the number of members of which they consist. The only way in which a council of any size can secure uniform and prompt action, is by a free delegation of its powers to smaller bodies or committees. It is in proportion as such committees are able and diligent, and have the confidence of the board by whom they are created, that good and vigorous work will be done. If boards consider it incumbent upon them to review the decisions of their committees, and to examine in detail the grounds upon which they have been formed, delay and uncertainity of action must inevitably ensue. But it must be confessed that if men well qualified adequately to perform the duties of such committees are not to be found, the board itself cannot escape from the duty of checking the results of their deliberations at whatever cost. Still the result must be that months and even years may elapse before any definite step is taken, not because the authorities are unwilling to act, but because they do not know how to set about it.

It is, I think, worthy of consideration whether greater powers might not usefully be entrusted to the Imperial Authority in many cases, though I am well aware of the dangers of centralisation, and the inauguration of a procrustian system under the dominion of red tape. But the central authority is at present often unable and generally unwilling to act as umpire between conflicting schemes and parties, and some extension of its operations in this direction under proper safeguards might be attended with advantage.

The policy adopted by many County Councils in appointing an officer of health for the whole county to supplement and to assist, though not to supersede the medical and sanitary officials is one which, if judiciously worked, may do much to secure uniformity of action, and a wholesome pressure. As the law now stands such an officer has only a moral authority, without any legal status, and some more definite, though moderate and limited recognition might well be conferred on him by statute. But even in his present position the influence he can bring to bear is in the highest degree valuable if he has the necessary qualifications for the task, will act with tact and moderation, and is met without prejudice by those with whom he comes in contact.

It will be seen from these somewhat desultory remarks that I am not disposed to consider that we have yet arrived at a point at which we can afford to rest satisfied with our achievements, or remit our exertions in the cause of sanitary reform. On the whole, however, the progress made has been real and steady. The nation has been thoroughly roused with regard to it. The gathering here to-night is a proof that the interest in sanitation does not flag, and I am only representing the sentiments of all present and of numbers outside these walls, when I express a lively sense of the share which the Institute has had in securing the results obtained, and an earnest hope that its members will consent to continue to devote their energies and their talents to the welfare of their country in this direction. When we look back a few years and note the advances which have been made, it is difficult to limit in imagination the feats which may yet be performed, and if the past be any guide to the future it is safe to predict as well as to desire for this Association a long, a beneficent and a successful career, and among its incidents I trust that the Congress, at Newcastle, of 1896, may be one of which the retrospect may be the source of complete and lasting gratification.

SECTION I.

SANITARY SCIENCE & PREVENTIVE MEDICINE.

ADDRESS

By Prof. W. H. CORFIELD, M.A., M.D.(Oxon.),
F.R.C.P.(Lond.),
(Fellow)
PRESIDENT OF THE SECTION.

THE TEACHING OF PUBLIC HEALTH.

Having accepted what I esteem as the great honour of filling the Chair of President of this section of the Congress, I had to consider what would be the subject most suitable for my address to you on this occasion, and it struck me, that as I have been a Teacher of Hygiene in a Metropolitan Medical School for twenty-six years, it might perhaps interest you to hear from me an account, however imperfect, of the progress made in the teaching of this subject.

Although Hygiene is a science of recent date, I can never speak of its history without referring to our "Old Masters," if I may so call them. All the great ancient teachers of Medicine, especially Hippocrates, Celsus, and Galen, and Herophilus, who divided Medical Science into three branches, (1) Dietetics, by which he certainly intended what we call Hygiene, giving it the name of what he considered the most important branch of the subject, (2) Medicine, and (3) Surgery, assigning, as you will see, the first place in Medical Science to Hygiene, shewed by their treatises, which have been fortunately handed down to us, that they attached the highest importance to the study of the methods for the prevention of disease; but even their treatises have not had anything like the influence upon the world's history that the works of Moses, the great Jewish Law-giver, who has described to us the practice and teaching of the ancient Egyptians with regard to the methods for preventing the spread of infectious diseases, and preserving the health of the community, have had.

Among our great teachers of antiquity I must also include the ancient Roman engineers, who showed us not merely how to drain cities, but how to provide them with pure water, and I must mention especially here the admirable treatise of Frontinus, the controller of the Roman aqueducts, a work which might even now be taken as a model for works on such a subject, especially as we are more and more every day coming to the conclusion that the Roman plan for the supply of water to towns from undeniably pure sources is far better than the modern plan of resorting to unquestionably polluted sources of water, and then devising ingenious methods for purifying that water before delivering it to the public for domestic uses.

The ancient Greeks too taught us an important lesson in the use of gymnasia, a lesson that we have learnt so well that now in our public schools the risk is run of gymnastic exercises and outdoor games being considered of even greater importance than the mental exercises which are generally understood to be the main object of the instruction given in the schools. But this branch of the subject has been so often described, and I have so frequently alluded to it myself on other occasions, that I feel I must no longer detain you with it, although it is so fascinating that I could with pleasure to myself continue it at much greater length.

Before coming to quite recent times, I must however allude to the important work done by Dr. John Caius (in honour of whom Caius College, Cambridge, was founded), in connection with the sweating sickness, as described in his "Boke or Counseill against the Disease commonly called the Sweate or Sweating Sicknesse," a disease of which, as Dr. Guy says, "Caius gives us a vivid notion of its severity when he says of those whom it attacked that it fearfully invaded them, fiercely handled them, speedily oppressed them, unmercifully choked them; and that in no small numbers, many of them being persons of rank and mark. It immediately killed some in opening their windows, some in playing with children in street doors, some in one hour, many in two, and at the longest to them that moderately dined it gave a sorrowful supper. As it found them so it took them, some sleeping, some waking, some in mirth, some in care, some fasting, some full, some busy, some idle, and in one house, three, five, seven, eight, or more, or all; so that if the half in any town escaped it was thought great favour."

Nor must I omit allusion to the admirable book of Dr. Nathaniel Hodges on the Plague, a work which has taught us more about that dreadful disease than all the other numerous works, of which I have a large collection in my library.

To come still nearer to our own time, I cannot help alluding to the remarkable self-sacrifice made by the Philanthropist

John Howard, in his grand work of reforming our prisons, by which we were taught how the gaol fever, or gaol distemper, as it was then called, the disease which we now know as typhus fever, might be prevented, and in time abolished; a lesson which I am glad to know we have so completely learnt, that the disease in question is now so rare, even in our large towns, that I am satisfied that few of the younger practitioners of medicine have ever seen a case of it.

Among our great teachers of Hygiene, I must not forget to include Edward Jenner, a medical practitioner in Gloucestershire, who, as you all know, discovered and taught to us the greatest prophylactic that the world has ever yet seen, or is ever likely to see, because it is the preventive of by far the most fearful disease that has ever yet afflicted mankind, a disease which in the opinion of a competent observer many years ago, had then killed ten persons for every person killed by the plague, an estimate which is now certainly very far below the mark.

It is a lamentable confession to have to make, that the country of Jenner, although the first to adopt compulsory vaccination, is not now the country in which small-pox least prevails: that honour belongs to Germany, where in March, 1874, on account of the fact that in those provinces of the German Empire, in which there had been laws requiring the vaccination of infants, small-pox was comparatively rare, whereas in those provinces, and notably in Prussia, in which there had been no such laws, small-pox epidemics had been frequent and severe, a law was passed making not only the vaccination of infants, but the re-vaccination of children of riper years, compulsory. The result of this has been that since that date small-pox has been practically abolished throughout that great Empire. It is indeed so rare in Germany now that many, if not most, of the younger medical men have never seen a case of it, and consequently are not able to recognise the disease when a case of it is introduced from some other country. To a certain extent we find the same thing here. Last year, of five cases certified to me as cases of small-pox, no less than three were cases of chicken-pox; I was just in time to prevent two of them being sent to the Small-pox Hospital, while the third was sent there and returned home.

The opponents of vaccination in this country appear not to have been abashed by the terrible object lesson of the Gloucester outbreak, and are even now holding up their heads again, and reiterating their preposterous fallacies. They again state, notwithstanding the fact that many years ago I exposed the falsity of it, that the fatality of small-pox was decreasing towards the end of the last century, and that this decrease would have continued had it not been for the introduction of vaccination. All the foundation for this astounding proposition is that the death-rate from small-pox was much less during the last four years of the last century, viz., 1797-98-99 and 1800, than in the years before, but these years come immediately after the terrible epidemic of 1796, the most severe of the century, and probably the most severe on record, an epidemic which caused no less than 184 deaths out of every 1,000 deaths from all causes, or nearly one-fifth of the total number. To show you how the fatality of small-pox was increasing towards the end of the last century, I may mention that the five most serious epidemics of that century all occurred in the latter half of the century, viz., in the years 1752, 57, 72, 81 and 96, each of these epidemics causing a mortality of over 150 deaths out of each 1,000 deaths from all causes, and the last one, as I said just now, occasioning the frightful mortality of 184 deaths out of each 1,000 deaths from all causes. It is therefore quite clear that the mortality of this disease, so far from decreasing, was increasing at a terrible rate during the latter half of the last century, and attained its maximum in the year 1796, only just four years before the end of the century. That the mortality during those four years was comparatively slight is a matter of course, as after a severe epidemic of any disease the mortality during a few succeeding years is necessarily small, owing to the small number of susceptible persons left, but had not vaccination been introduced early in the present century there can be no doubt that the mortality from small-pox would have gone on increasing, and that there would inevitably, as the history of the latter half of the last century shows, have been in a few years another epidemic of similar fatality to the five which occurred in the latter half of the last century.

We are also told that the Swedish statistics, which are very complete for a considerable number of years, show that the small-pox mortality was decreasing before vaccination was introduced. I have before me these statistics for a period of 124 years, viz.:—from 1749 to 1872 inclusive, in a pamphlet written by a Swedish opponent of vaccination, who considers that they prove his case. What they show, as I pointed out many years ago in a public lecture at Birmingham, is this—that the whole period is divisible into two nearly equal periods, the first of 61 years, from 1749 to 1809 inclusive, during which vaccination was not practised, and the second of 63 years, from 1810 to 1872, in which it was.

During the first or non-vaccination period, there was only one year in which the deaths from small-pox in that country were under a thousand, and there were nine years in which they were over 10,000, while during the second, or vaccination period, there were no less than 48 years in which the number of deaths was under a thousand, and in no year did they reach 10,000, or even 3,000. The greatest number of deaths in any one year during the first period was 16,607, and the least number 671, while in the second, or vaccination period, the greatest number was 2448, and the lowest number was 2. That an attempt to make out a case against vaccination from such figures should be made by anyone, shows what an effect prejudice has on the minds of otherwise sane people.

These facts are not new, and indeed are clearly stated in my small text-book for elementary schools ("The Laws of Health"), of which over 20,000 have been issued, so that we may hope that a knowledge of the truth on this matter will gradually be spread.

A Royal Commission has, as you know, after sittings lasting over a period of some five years, just issued its Report approving of compulsory vaccination, but not of cumulative penalties if a conscientious objection is raised. It seems to me that this is not a question of conscience at all, but of the well-being of the community, and if conscientious objections are to be allowed it appears to me a farce to continue compulsory vaccination. My view is that in the interests of the community at large, in order to prevent the spread of the most dreadful infectious disease that the world has ever seen, compulsory vaccination and re-vaccination are absolutely necessary, and that the conscientious objections of persons who are either entirely ignorant of the subject, or who are misled by the specious arguments of interested agitators, or I may add of "blind leaders of the blind," ought not to be listened to, and I cannot help wondering after the severe object lesson that has been given to us in the Gloucester epidemic of small-pox, that such objections have had so much weight attached to them. We are told that those who believe in vaccination can have themselves and their children vaccinated. I am perfectly willing to accept that position for the vaccinators if I am driven to it, but I can see that the result will be that those who are foolish enough not to accept the advantages offered them by vaccination, will gradually perish by one of the most loathsome diseases that has ever inflicted the world.

A foremost position among the great pioneers of public hygiene must be accorded to the Frenchman, Parent Duchatelet, who investigated the diseases prevalent among workers in various industries, and whose remarkable work on public hygiene, issued in 1836, must always remain as the first important classical work on the subject.

In our own country I must refer to the work of Dr. Snow, who taught us that cholera was communicated by drinking water; of Drs. Stewart, Budd, and Sir William Jenner, who unravelled the mysteries of enteric fever, and shewed that it was not, as was formerly supposed, a form of typhus fever, but a separate disease spread in a different manner; of Sir Edwin Chadwick, Drs. Southwood Smith, Neil Arnott, Sir Henry Acland, and Sir Benjamin Richardson, who were the pioneers in this country in the great development of public health thought, work, legislation, and teaching which has since taken place, and of whom the last was one of the early founders of this very Institute.

The work done by the General Board of Health, of which Edwin Chadwick was Chairman, and the impetus given to sanitary work in this country by the Reports of the Health of Towns Commissioners in 1843-4-5 cannot be over-estimated. This work was followed by the important Acts, known as the Metropolis Local Management Act, the Nuisances Removal Act of 1855, and the Sanitary Act of 1866; and ultimately by the Public Health Acts now in force, that of 1875 for the country generally, and that of 1891 for London, besides a number of other important Acts in connection with the public health, of which I must especially mention the Act providing for the Notification of Infectious Diseases, which was largely brought about by the independent and original work of Prof. Philipson of Newcastle-on-Tyne (who published "Reports on the Prevalent Diseases of the District, and Statistical Tables of New Cases of Infectious Diseases," from 1863 to 1870), of Dr. Arthur Ransome of Manchester, and of the late Dr. Rumsey of Cheltenham.

As you well know, the general death-rate of this country has decreased since the passing of the Public Health Act of 1875, and I have no doubt that a similar result will follow the London Act of 1891. This leads me to ask, how far can such reduction go? Is it for instance within the bounds of possibility that the permanent death-rate of a mixed community should be as low as 10 per 1,000 per annum?

The notion has got abroad that a death-rate of 10 would imply a mean length of life of 100 years, and that therefore so low a death-rate as 10 cannot be attained. But this is a fallacy; the mean length of life depends upon the birth-rate as well as upon the death-rate, and not upon the death-rate alone, and with a death-rate of 10 there must also be a birth-rate of 10 to make the mean length of life 100 years; and any other birth-rate with the same death-rate would imply a different mean length of life.

The birth-rate required to produce any mean length of life with a given death-rate, can be calculated with sufficient accuracy by means of Dr. Bristowe's ingenious formula; we thus find that with a death-rate of 10 the mean length of life would be just under 70 if the birth-rate were 20 per 1000 per annum, and would be 55½ with a birth-rate of 30, and a little under 51 with a birth-rate of 35. Now I have calculated the mean length of life in London during each of the past 18 years, and in St. George's, Hanover Square (of which I have been Medical Officer of Health for just a quarter of a century), for the past 21 years, and I find that in London it has averaged nearly 39 years, and in St. George's, Hanover Square (a somewhat exceptional district), over 55 years, while during the last 10 years the figures come out at 40½ years for London, and nearly 60 for St. George's, Hanover Square.

Are we, then, to say that a death-rate of 10, which with a birth-rate of 30 (the present birth-rate in London) would imply a mean length of life of 55½ years, is unattainable? Certainly not! It is not only attainable but it ought to be attained, and I do not despair of even a lower death-rate being reached in some of our large towns.

Above all, perhaps, I ought in this connection to refer to the all important and delightful reports of Mr. (now Sir John) Simon, then Medical Officer of the Privy Council, whose admirable work has been so well continued by his successors, the late Dr. Seaton and Sir George Buchanan and the present chief Medical Officer of the Local Government Board, Dr. Thorne Thorne.

Before the teaching of hygiene had become general in our Medical Schools, Dr. Gairdner was giving important lectures in Glasgow on the subject, and a Professorship of Hygiene had been founded by the Royal College of Surgeons in Dublin, as early as 1841, Dr. Henry Maunsell being the first Professor. He resigned the chair in 1846, and it was not filled until 1864, when Dr. Mapother, then Medical Officer of Health for the City of Dublin, was appointed, and delivered a course of lectures on Public Health, a course which, I need hardly say, embraced all the most important parts of the subject, and treated them in a most admirable manner. Since 1867 the chair has been worthily filled by our friend Sir Chas. Cameron, whose excellent work in Dublin is well known to you all.

The next appointment of Professor of Hygiene in this kingdom was that of Dr. Edmund Parkes, who was appointed Professor of Hygiene at the Army Medical School at Netley in 1860, and whose "Manual of Hygiene" has been the great text book of the subject ever since he issued it. Of Dr. Parkes, whom I had the honour to know personally, I can only speak in terms of the greatest reverence, and I regard him as the great pioneer of the teaching of hygiene, not only in this country, but throughout the world. Dr. Parkes was an altogether exceptional man, he was not only a great hygienist and a great physician, but he had also a great practical acquaintance with chemistry and physiology as well, and he knew how to turn his knowledge to the best account in the interest of sanitary science. What is more, he was able to impress the stamp of his character upon his pupils and upon all who came in contact with him. I regard him as one of the greatest teachers that this country has ever seen. His work at Netley has been admirably carried on by his successors, my friends the late Dr. de Chaumont and Dr. Lane Notter.

It is a matter of curious interest that although, as we have seen, a Chair of Hygiene was founded by the Royal College of Surgeons of Dublin in 1841, and Dr. Parkes was appointed Professor of Hygiene at Netley in 1860, and Dr. Gairdner was lecturing on the same subject in Glasgow in 1862, no Medical School in London thought it necessary to take up the subject until 1869, when the Council of University College, London, thought it advisable to institute a Chair of Hygiene, and I was appointed the first Professor. At the time of my appointment I was at work in Paris, following the general routine of the Medical School there, and more especially attending the lectures of the Professor of Hygiene, Dr. Bouchardat, whose name is no doubt well known to you all, and whom I shall always remember, from the interest he took in me and my work, with the greatest affection, and working in the Laboratory of Berthèlot, the Professor of Chemistry at the Collège de France, the man who had even then made himself a great name in the scientific world as the Father of Synthetical Chemistry, and who has since become even still more known to the world at large as the Foreign Minister of the French Republic. I cannot help telling you in this connection what occurred to me one day in his laboratory. I was counting drops from a pipette when I suddenly heard a sound which made me think that part of the Collège de France was falling down; the glass front of the laboratory shook with the vibration. It did not occur to me to see what had taken place until I had finished counting my drops. When I had done so I found that I was the only person in the laboratory. I then ran out into the courtyard and saw everybody hurrying to the street; I followed them, and ran along a street paved with broken glass, into the square. I was then told that a terrific explosion had taken place in the chemist's shop at the corner of the square, and the physical signs that I saw left no doubt in my mind that such was the case. I heard afterwards that in the cellars of that chemist's shop a large quantity of picrate of potash had been stored, by order of the Emperor, for experiments upon the action of that explosive. Why I mention this is that I observed as the result of that explosion that whereas almost every window within a radius of I suppose a quarter of a mile from the spot was broken, there were certain houses in which there was not a pane of glass fractured, showing that the effect of the explosion on the air was the propulsion of waves, thus indicating points of rest which were unaffected by the explosion. What makes me describe this more particularly is that in a recent case in which I was engaged the theory was propounded that a local smell could be propagated to a distance with a comparatively still atmosphere without affecting places intervening. This I am satisfied is an utter impossibility, as such an effect could only be produced by means of an explosion.

For many years I lectured at University College to a few students who came either from curiosity, or, it pleases me to think, from a genuine interest in the subject; at any rate it is quite certain that they did not come on account of any requirements of the Examining Boards: and after a time I induced the Council of the College to allow me a small room to fit up a Hygienic Laboratory, the first laboratory of its kind established in London, and the first in this country, with the exception of that of Dr. Parkes at Netley. In this little room, with the aid of my able assistants, especially Mr. Cassal and Dr. Louis Parkes, a number of men were trained in public health work who rapidly gained appointments in various countries, and have been the pioneers of practical public health work in all parts of the British Empire, and not only of the British Empire, but all over the world. I well remember an Italian Hygienist who came over to this country, and who wanted me to show him my laboratory. I was at first very loth to do so, as it was vacation time, and as I knew he would only see a small room with a few bottles in it. However, he insisted, and after seeing it and the few bottles therein, expressed himself delighted, and in order to explain his satisfaction to me, said "Dr. Corfield, to me going from here without to see your laboratory would be like as one going from Rome without to see the Pope." I need not tell you I felt highly flattered by the comparison, and it revealed to me what I really did not know before, how much that little room had done for the propagation of hygiene throughout the civilised world.

After this laboratory at University College had been established, it was resolved to establish a memorial to the late

Dr. Parkes of Netley, in the form of a Museum of Hygiene, in connection with University College, with which he was formerly connected. This Museum was inaugurated and housed in that College, which thus became with its laboratory and Museum the centre of Hygienic teaching in London.

Unfortunately for University College, it was found that the space occupied by the Museum there was wanted for other purposes, and the then Council did not sufficiently recognise the importance that the teaching of Hygiene was about to play in medical education, although it was the Council of the same College which had first in London appointed a Professor of Hygiene. I did all that I could do to prevent the severance of the Parkes Museum from University College, as I foresaw that it would be a bad thing for the College, although an excellent thing for the Museum. The upshot was that the Museum was given notice to quit, and that it was established as a separate Educational Institution. In this way it continued to exist for some years, until it was affiliated with the Sanitary Institute of Great Britain, and the two bodies were amalgamated under the title of the Sanitary Institute.

I have no doubt that the result of these proceedings has been of great advantage to the Parkes Museum, to the Sanitary Institute, and to the public generally, especially as the Sanitary Institute has obtained a large grant from the Berridge Fund to help it on its way, but I have also not the slightest doubt that the severance of the Parkes Museum from University College was a great disadvantage to that body, as its continued association with it would have necessitated its remaining what it was, and what in spite of that, I am happy to think it still is, the leading school of hygiene in London.

After the establishing in University College of a professorship of hygiene, similar appointments of necessity followed in the other Metropolitan schools, and in the same year Dr. Wm. A. Guy was appointed professor of hygiene at King's College. Of his admirable lectures on various branches of public health, especially from a historic point of view, it would ill become me to speak except in terms of the warmest admiration. His works are too well known to you all to require any lengthened comments from me. He was succeeded in the professorship by Dr. Kelly in 1878.

The other medical schools have followed in the lead given by University and King's Colleges, and have appointed professors or teachers of hygiene, but I am of opinion that in this, as in several other branches of medical education, the teaching should, and must of necessity be concentrated in a few large schools where suitable laboratories can be properly equipped for the satisfactory teaching of the subject. I am now referring especially to the Metropolitan schools. Each of the great provincial medical schools must of course have its professor of hygiene with a properly equipped laboratory, and I am sure that in no one of these is the subject better taught than it is here by my excellent friend Dr. Armstrong.

On account of the increasing importance of special hygienic knowledge it became necessary that some examining body should issue a certificate of fitness in that subject, and the first to do this was the University of Cambridge, which, under the advice of Sir Geo. Humphry and Sir Geo. Paget, started an examination in public health in 1875. The example of that University has been followed by no less than 14 examining bodies in the United Kingdom, most of whom grant a diploma in Public Health or State Medicine, and three of whom, viz.:—the University of London, the University of Durham, and the University of Edinburgh, grant a degree of Bachelor or Doctor in Public Health. This is a great step gained in the education of medical students from a public health point of view, and became of still greater importance by the fact that the diploma in public health was made a registrable diploma under the Medical Act in 1886, at the instance of the Association of Medical Men qualified in Sanitary Science.

But apart from medical examinations in hygiene, others have been instituted in this country. The Science and Art Department at South Kensington resolved in 1884 to include hygiene in the subjects for examination of students, and a syllabus was prepared by the late Professor Huxley, Capt. Abney, and myself. At the first examination for this subject over 2,200 students presented themselves, and this number was increased in succeeding years to over 4,000. A similar examination was carried on for some years at the Society of Arts, at which also a large number of students presented themselves for examination, thus showing that the interest engendered in hygiene is not confined to the medical profession but is shown also by the community at large, and that, as I said many years ago, if the medical profession do not take an interest in hygiene it will soon find that the general community is ahead of it in that subject. I must also mention the examinations for sanitary inspectors, that have now been held for a number of years by this Institute, and on passing which a certificate is granted which is recognised by the Government as the certificate to be required of persons holding the post of sanitary inspector. I consider that the country is greatly indebted to this Institute for establishing and carrying on for so many years these examinations, and thus procuring the better education of sanitary inspectors in the important subjects with which they have to deal.

I must here digress to insist on the absolute necessity of properly qualified examiners, men who have a practical acquaintance with the many subjects comprised in public health work. I speak with some authority on this matter, as a great deal of my time, during the past thirty-five years at any rate, has been passed in being examined and in examining others, so much so that a tutor at the college at which I was an undergraduate, some years afterwards told me that my face always reminded him of an examination paper, and I say deliberately that no man ought to be appointed an examiner in a practical subject, like public health, unless he has himself a thoroughly practical, as well as theoretical, acquaintance with it. What would be said if an examiner were appointed in anatomy who had never been in a dissecting room, or an examiner in surgery who had never performed an operation, or an examiner in chemistry who had himself done no laboratory work? And yet a similar thing has been done, not once nor even twice, by public health examining bodies, though never, I believe, by this Institute.

Two things are especially required of an examiner, one that he should have as complete a command of his subject as possible, and the other, that he should try to find out what the candidates know, and not what they do not know. The first gives the candidates confidence, for every candidate knows that the best man may easily be plucked by an incompetent examiner, and the second is only fair treatment. The practice of asking questions which a candidate is not likely to be able to answer, is resorted to by examiners who feel that they are not well up in the subject, and who want to give the impression that they know a great deal about it, and who have, "heaven save the mark," to get it up for the examination as if they were the candidates, and also by young examiners, who, although they may know the subject very well themselves, have not yet learnt the very difficult art of finding out what the candidates know, the art, in fact, of examining. A man ought not, in my opinion, to accept the position of examiner unless he feels that he can sit down and write a suitable paper of questions on the subject just as he would write a letter to a friend, and every examiner ought to make up his mind to ask questions which the candidates can be reasonably expected to answer correctly, and not questions which he knows, or ought to know, are beyond them, bearing in mind the old and very true saying, that "A fool can ask questions which a wise man cannot answer."

Among Colleges where hygiene is now taught systematically, besides those I have already mentioned, are Owen's College, Manchester; The Yorkshire College, Leeds; and Bedford Ladies' College, London; and among Societies who have made it their business to promote hygienic teaching, I may mention above all others our own Sanitary Institute, and next to it the National Health Society, the Manchester and Salford Sanitary Association, the Ladies' Sanitary Association, the Royal British Nurses' Association, and also the Birmingham and Midland Institute, and the Saltley Training College, Birmingham, at both of which I was a lecturer on public health for several years; and a number of Technical Institutions under the regulations of County Councils, and various Polytechnic Institutions throughout the Country.

I must also not omit to mention the American Public Health Association, and the work done by various Boards of Health in the United States, especially the experimental work done under the direction of the Board of Health of Massachussetts during several years past.

In Germany public health work has been admirably carried on. The establishment of the Hygienic Institute of Berlin under the direction of Dr. Koch, with whose superb researches you are all well acquainted, being the best evidence of this fact.

To come to special hygiene, the splendid work of Pasteur and the foundation of the Pasteur Institute in Paris, are ample evidence of the activity of our French friends in this direction.

Nor must I forget to mention the Hygienic Institute at Budapest, with its able Director my excellent friend Professor von Fodór, whose admirable researches are well known to you, and several of whose pupils have filled chairs in other Universities.

But to come back again to ourselves, it was not only necessary that the diploma in public health should be made a registrable diploma under the Medical Act, as it was, as we have already seen, in 1886, for that would only imply that the few medical students who cared to avail themselves of the advantages of an education in public health, and to obtain the diploma, should thereby obtain an additional qualification. What was required was that an adequate education in public health subjects should be required of all medical students. This was not insisted upon, although advocated for many years by the exponents of public health education, until it was last perceived that the public were rapidly getting ahead of the medical profession in their knowledge of matters concerning the public health, and then, in 1892, hygiene was made a compulsory subject for all medical students.

I must not here omit to add what I had almost forgotten to state, that the room used as a Hygienic Laboratory at University College having been found too small, the Council have assigned a much more spacious room, well-lighted, and with a private laboratory and lecture room adjoining, to the Hygienic Department, and that in this, with the able assistance of Dr. Kenwood and Dr. Childs, a complete course of instruction in practical and theoretical hygiene, including bacteriology in connection therewith, is now carried out.

I have deliberately kept the subject of Congresses to the last, and for reasons which will doubtless commend themselves to you. The first Congresses which took cognisance of sanitary science subjects were those of the British Association, which appointed a Committee on the Treatment and Utilization of Sewage, which committee sat for seven years, and issued a number of most valuable reports, and by their investigations established a number of important points in connection with that subject; as I was for seven years a member of and reporter for that committee, I could, as you may imagine, dilate at considerable length on the results obtained by the experiments carried out by it, but I will not trouble you with them; they can be found in the Reports of the British Association: and the Social Science Congress, in the transactions of which are some very valuable reports on Water Supply and on the methods for the Disposal of Sewage.

The Sanitary Institute has, as you know, inaugurated a number of Congresses during many years past, in connection with which Exhibitions have been held, and prizes given after the most searching examination and testing, and the results of these examinations are now held by experts, and by the public, to be the true test of the fitness of sanitary appliances.

Congresses have also been held by another body known as the British Institute of Public Health, and while I should not wish to discourage any meetings which tend to the spread of a knowledge of sanitary science and of public health work, I cannot help regretting that so much energy is scattered by the holding of more than one congress of the kind in this Kingdom in one year.

International Congresses of hygiene have been held for many years past since the one held in 1877 in Brussels, under the auspices of the King of the Belgians.

I was requested to deliver an address at the Congress held at The Hague, in 1884, and was then asked by various foreign friends why the International Congress of Hygiene had never been invited to London. I said, that in the first place, the English Government gave no aid to such congresses, and that in the second place there was no sanitary body in London sufficiently strong to invite such a congress to hold its meeting there. I, however, watched for my opportunity, and when it was proposed to amalgamate the Parkes Museum with the Sanitary Institute, I found it. I then urged the Councils of both bodies to unite in forwarding an invitation to the Permanent Committee of the International Hygiene Congress to hold its next meeting in London, and the result was that it was resolved, at the Vienna Congress in 1887 (after a severe struggle between Russia supported by France, and England supported by Germany and Austria, the minor powers arranging themselves on one or other side), that the next International Congress of Hygiene should be held in London in 1891. His Royal Highness The Prince of Wales graciously consented to become President of the Congress, the success of which was thereby assured. Sir Douglas Galton, who has been so good a friend to this Institute, was chairman of the organising committee, and by far the greatest Congress of Hygienists that the World has ever seen, numbering over 3,000 members, was therein assembled.

The next International Congress of this series was held in Budapest in 1894, and was very largely attended, and the following one has been fixed for next year at Madrid. These Congresses have become too unwieldly, and some means must be taken to limit them to persons really interested in the subjects treated, and also to exclude subjects which ought to be omitted as not coming within the scope of the Congress; for example—there is no reason why there should be a section of pharmacology in a congress of hygiene, and such controversial political subjects as the question of the eight hours day for labour, must be rigorously excluded.

The permanent committee of the International Congresses of Hygiene have considered these points, but the limitation of the number of members presents considerable difficulties, as the financial question has to be faced, and the cities receiving the congresses cannot be expected to forego the means for recouping themselves part of the expense they are put to, and the organisers of these Congresses may be expected to take a similar view.

With regard to the exclusion of unsuitable subjects, Dr. Billings, of the United States, and I made a stand at the final general meeting of the Congress at Budapest, and not only obtained the rejection of a number of resolutions relating to such subjects, but induced the Permanent Committee to include in the scheme prepared for the regulations of future Congresses, one providing that all subjects partaking of a political or religious character should be excluded.

While I have on this occasion reserved to the last the consideration of work done by Congresses, I must not be interpreted to mean that this work, although very important in spreading a knowledge of hygiene throughout the world, is the most important work that has to be done. By far the most important work is that which is done in the class-room, the laboratory, and out of doors, or shall I say in the courts and alleys of our great towns. It is in these places that an accurate practical knowledge of public health work in its various branches can only be acquired. The acquisition of such knowledge is a labour of years, and requires the devotion of a lifetime, and if I have, in the short time allotted to me, been able to demonstrate a little of the importance of the proper teaching of this all-important subject my trouble will have been amply repaid.

EARL PERCY moved a vote of thanks to Professor Corfield for his address, and in doing so said, Professor Corfield's very interesting address has had one great merit amongst many others, that while it is of a character which I am sure will commend itself even to those who are best acquainted with the subjects with which it dealt, yet at the same time it is intelligible and interesting to those of a meaner capacity and less training than some of the gentlemen who have heard it. I myself was particularly interested in the reference to vaccination, because that was a subject which I took considerable interest in when I was in the House of Commons, and I saw a good deal of the fight between the vaccinationists and the anti-vaccinationists. I should like to say one word with regard to what the lecturer said upon the subject of cumulative penalties. The President has remarked that the dislike to vaccination is not properly so called a conscientious matter. Without disputing that the least in the world, the real difficulty is, not whether a man deserves cumulative penalties or not, but whether cumulative penalties produce good or bad results. If you get a man—you may call him conscientious if you like or you may call him pig-headed if you like—who is perfectly determined that he will not vaccinate his child, the only effect of punishing him over and over again is to create a feeling of sympathy in the country on his behalf, and so spread the anti-vaccination feeling, rather than the reverse, throughout the population. If vaccination is to be compulsorily enforced the proper course would be this: to fine a man for the first offence; and the second time to send him to prison without the option of a fine. No one likes to be locked up and if the man went to prison once it would prove whether he really has what he says he has, a conscientious objection. Then having done that I think it is no use going on any further. I do not dispute now whether a man deserves to be further punished, but I say, that it does not produce any good effect; and the only other course you can pursue—and you must be prepared to do it, or I think it is useless to discuss the matter any further—the only other thing you can do is to take the child out of the parents' hands and vaccinate it compulsorily by the State. The question is whether that is a justifiable, and if it is, whether, in these days, it is a practicable course to adopt.

Prof. G. H. **Philipson**, M.D. (Newcastle), seconded the motion. He said: The Sanitary Institute could not have selected one more acceptable to them to occupy the important position of President of this Section than Prof. Corfield. The President has chosen a very appropriate subject, and he has treated it with great ability. I take this opportunity of tendering my thanks to Prof. Corfield for his kind allusion to the efforts I made from 1863 to 1870, respecting the notification and registration of disease. It was through the profession of the Northern Counties that I was able to present those reports on the prevalent diseases in Newcastle and Gateshead, and which were embodied in the reports of the Northumberland and Durham Medical Society. I must also thank the President for the kind reference he made to my distinguished colleague, Dr. Armstrong; and, on behalf of the Medical College of the University of Durham, I tender my thanks to Prof. Corfield for his allusion to their efforts respecting the advancement of education in this College, and the Examinations in connection with Hygiene, especially the Degree of Bachelor of Hygiene which has been established by the Durham University.

Surg.-Major **Hutton** (Leamington), briefly supported the motion, which was carried.

SECTION II.

ENGINEERING AND ARCHITECTURE.

ADDRESS

BY SIR ANDREW NOBLE, K.C.B., F.R.S., F.R.A.S., F.C.S., M.Inst.C.E.,

PRESIDENT OF THE SECTION.

IN addressing you to-day, I must first ask you to extend to me that kind indulgence which the expert is always ready to show to the layman, and to forgive me if I speak on general rather than on special subjects. Although I am an engineer, and proud of the designation, I have never devoted special attention to that branch of engineering with which this Congress is more immediately concerned. I say "special" attention advisedly, for it is quite impossible for any man of ordinary intelligence to avoid paying some attention to such vital questions as are involved in sanitary engineering. Indeed, the strides which have been made by that science in recent years are so remarkable as to thrust themselves upon the notice of even the most careless or the most absorbed. There is a proverb which says a man at forty is either a fool or a physician; and a man of my age, who has lived in a good many houses belonging to other people, and built several of his own, must surely be a fool if he be not something of a sanitary engineer.

I am old enough to claim to have seen the very beginnings of sanitary engineering in the modern sense of that term, for I think that we may fairly attribute its inception to the passing of two measures in 1847 and 1848, the Town Improvement Act, and the Public Health Act. These Acts were the outcome of the rapid growth of great English towns and the prevalence of zymotic disease. Certain architects, engineers, and mechanics, were then led to devote special attention to the practical methods of ameliorating public health, and proved to be the forerunners of the sanitary engineers as we have them to-day, a class as necessary as able, and as appreciated as any in the community.

Before that time no serious attention had been given to sanitation. Everything that was done in that direction was done by rule of thumb; and if any sanitary improvements were made at all, it was only in special instances where abominable smells or virulent outbreaks of disease forced the hands of those in authority. Commissions, appointed after the passing of those Acts, to inquire into the causes of the terribly high death-rates which then ruled found that everything was wrong. The drainage of private houses, which, as the unit, must always remain by far the most important item of any sanitary scheme, was altogether defective; the houses themselves were generally badly designed from a sanitary point of view. There was, as a rule, no public water supply, and the wells from which most houses drew their water were contaminated. There was no comprehensive scheme of town drainage. But even after the awakening, progress was at first very slow, because everything had to be done *ab initio.* Knowledge of this kind can only be gained through experiment, and experiment implies a considerable amount of failure. Looking back from the standpoint of our present knowledge, we are surprised that so many of the early schemes of drainage and water supply should have proved as successful as they did. But among the successes there were a large percentage of failures, some of them gigantic failures, involving the waste of very large sums of money. Such unfortunate enterprises were of course discouraging, and in spite of the stimulus to sanitary reform given by the great outbreaks of cholera in 1849 and 1854, comparatively little was done in the first years that followed the Improvement and the Health Act. In 1866 came a slighter irruption of cholera, and from that date I think it may be said that sanitary progress doubled its pace. It is the last quarter of a century that has witnessed those improvements and sweeping sanitary reforms that have placed England so far in advance of any other country as regards hygienic matters.

My business has compelled me to travel much, and for many years I have had exceptional opportunities of observing Continental life. I do not say that I have given special study to a comparison of their sanitary arrangements with ours; but from a consideration of health statistics, and from the obvious facts that strike a commonly observant traveller, I have no doubt at all that we are immeasurably in front of our neighbours in these respects. The Continent, I should say, as regards sanitation, is generally in much the same position as was England in the sixties. Of course there are degrees, and

Germany and France are in advance of Italy and Spain. But even Germany, with all her incomparable scientific accuracy and research, is only now awaking to the necessity of vigorous action in this direction; and when the outbreak of cholera at Hamburg in 1892 threw a strong light on that city, abuses were then made visible that would certainly not now be possible in any English town. And in speaking of the cholera outbreak at Hamburg, I may be permitted perhaps to remark that it taught a lesson as to the importance of the filtration of the water supply of towns such as never was taught elsewhere so clearly. Taking the two districts of Hamburg and Altona, which in reality form with Wandsbeck one great town called Hamburg, the water supply of Hamburg proper was drawn from the river Elbe above the town where the stream is presumably little contaminated by sewage; the water for Altona was taken from the river Elbe below the town after it had received all the liquid and fœcal refuse of 800,000 people. *Primâ facie* one would suppose that the Altona district would have suffered the most from cholera if there was to be any difference at all. But the contaminated water of Altona was filtered, and the purer water of Hamburg was not filtered, before it was delivered to the town. The remarkable results are best described in Dr. Koch's own words: "On both sides of the boundary between Hamburg and Altona," he says, "the conditions of soil, buildings, sewage, everything shortly of importance in this respect were the same; and yet the cholera which ravaged unfiltered Hamburg went right up to the walls of filtered Altona and there stopped. In one street, which for a long way forms the boundary, there was cholera on the Hamburg side, whereas the Altona side was free from it. Indeed, in the case of a group of houses on the so-called Hamburger Platz, the cholera marked out the boundary better than anyone having the map of the frontier between Hamburg and Altona could have done. Here we have to do with an experiment in sanitation performed on an immense population, and that experiment, in spite of its gigantic proportions, complied with all the conditions which one requires from an exact and perfect experiment in a laboratory."

In these days of fierce competition, when Continental rivalry is such a bugbear in almost every trade, it is satisfactory to find that England more than holds her own in the field of sanitary engineering. I wish I could say the same of that branch of the engineering profession with which I am myself more closely connected; but a variety of circumstances unfortunately combine to render this impossible. The manufacture of the various sanitary appliances is in itself an enormous industry, and on the sanitary arrangements of almost all the great Continental hotels may be seen repeated, over and over again the familiar names of English makers. Some of these names are little short of household words, and I have been interested in advertisements of foreign hotels to see, more than once, a prominent statement that the sanitary arrangements are by so and so (naming some great English firm) as a practical guarantee of their hygienic efficiency. In the whole of the vehicles of the International Sleeping Car Company, which are found wherever railways themselves are found, and which travel from one end of the civilized world to the other, you will see all the lavatory appliances supplied by a celebrated Birmingham firm. This may seem a petty fact enough, but it is nevertheless a curious tribute to the proficiency which English makers have reached in these matters.

After I had accepted your very flattering invitation to be President for this year of the mechanical section of your Society, and found too late that an inaugural address was expected of me, I began casting about for some subject on which a layman might venture to speak before a company of experts. The first thing that struck me was the enormous extent of the field covered by sanitary science, trenching as it does on the province of the architect and the artist, the engineer proper, and the doctor. It is indeed curious to reflect how very dependent on one another are the doctor and the sanitary engineer. The plague of small-pox, which is, we hope, just lifting from Gloucester, has shown that all the advantages of modern sanitation will not avail where medical precautions are neglected; and the doctor on the other hand will find his skill and medicine impotent, if his patient is living in an ill-drained and ill-ventilated house.

The subjects which might be legitimately reviewed before your Congress are numberless as they are important; but it would be affectation on my part to attempt to speak on any purely technical questions. They are better left for departmental treatment by specialists where more opportunity is afforded for discussion than can be the case with a presidential address. But whatever one may say, technical details cannot be altogether eliminated; and so I hope that if you should find me tripping, you will exercise forbearance and regard me as *wishing*, at least, to approach the subject in a general manner and from a layman's point of view.

There are many problems arising out of the growth of population which call to-day for the attention of the sanitary engineer, but none are more urgent, I think, than that of the water supply for large towns. There is no concealing the fact that the present provision of water is in many cases (perhaps in most cases, if we take exceptional seasons into account) inadequate. During the last few years we have been passing through a cycle of drought, and it is as impossible for us to predict how long these droughts will last as to conjecture their causes. In the South of England a climax has been reached in the present summer, and, as you are aware, a most serious failure has resulted in the water supply of London. Here in the North, we have not felt the same severe drought, yet the general dryness of the seasons has more than once made the board of the Newcastle and Gateshead Water Company (to which I have the honour to belong) exceedingly anxious. The population of Newcastle is increasing so rapidly as to tax to the utmost our efforts to provide water. The present rate of increase is at the rate of three per cent. per annum, a rate, I believe, only paralleled in England by that of Cardiff. If Newcastle is, as many think it, a black and coaly place, it is not for want of water to wash with. The consumption in the city now reaches the proportion of thirty-eight and a half gallons per head of the population. Of this, fifteen gallons is expended on manufactures and on public needs, thus leaving twenty-three and a half gallons per head for purely domestic purposes.

It is not too much to say that an ample supply of water is the first requisite of town sanitation. Apart from drinking purposes, personal cleanliness is impossible without it and healthy dwellings are impossible without it, because experience has shown that a water-borne system of sewage disposal is the only one admissible for town use. The water-borne system has, no doubt, grave disadvantages: it pollutes and makes sewers of our rivers; it increases enormously the volume of noxious matter to be dealt with; it manufactures noxious gases that would not otherwise exist, and through the pipes, it transports them to places where they are dangerous and to which they would not otherwise be transported. Yet in spite of these drawbacks, all efforts to supersede it have so far been unsuccessful, and it may be taken for granted that the water-borne system must prevail in towns for many years to come, and any prospective provision of water must be based on that supposition. I fear we must leave to the sanitarians of the rising generation the solution of the problems involving the disposal of our sewage and the purification of our now polluted rivers.

The demands on a water supply have greatly increased of late years, and are increasing every day. A more frequent and much more complete flushing of sewers is now provided than was considered requisite a few years ago. In Newcastle we are fortunate in being able to secure for the most part satisfactory gradients for our sewers, but the limited space available in towns for building purposes leads very often to the erection of houses in situations where a thoroughly satisfactory fall is not obtainable. Such situations demand exceptionally powerful flushing of the sewers, and much more water is required for that purpose. Water-closets are coming into nearly universal use, and baths* are very common even in low-rented houses. This means again more water.

The bath-room, or at any rate the large fixed bath, is now a recognised feature of even the most modest houses. From being a luxury of the few it has made its way downward to the lowest fringe of the middle class, and in another ten years will probably be considered a requisite by the masses. I know scarcely any direction in which sanitary progress has been more marked than in this essential. When I was a boy, a bath-room was a very noticeable rarity. I cannot recollect many country houses that had one at that time, though a few had cement or marble baths in summer-houses in the grounds. But these were dreary places at the best, most of them never used because the water supply was out of gear and frequently ruinous. They were, I think, unknown even in the first-class London hotels; and it is a curious fact (as illustrating the slowness of sanitary progress on the Continent) that the chief hotel in Brussels has no bath-room to this day. There are now baths in houses in Newcastle with a rental as low as £15, and they are being fitted, I am told, in many of the superior tenement houses.

This is a very significant fact, and I attach much more importance to it than to the multiplication of public swimming baths, of which one hears so much now-a-days. The Corporation of Newcastle have established a number of swimming baths in this town, but report says that they are by no means so well patronised as might have been expected. The climate, in truth, militates against any extended use of such baths unless they are kept at a higher temperature than is admissible. It is not probable that the public bath will ever become a feature of every-day English life, and it is more than doubtful whether such a consummation is one to be wished. Certainly if such places are to draw large numbers, they must be made far more attractive than they are at present, and offer other inducements beside those of bathing. The system of public bathing was brought to its perfection in Rome of the Empire, and those who care to study the subject will find in classical authors the most detailed accounts of these glorified baths. They were on a scale of luxury and magnificence that will probably never again be approached; but if they were not (as many historians think) a chief factor in the demoralisation of the Roman character, they proved themselves to be at least no unmixed blessing.

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* There are 26,000 at present fitted in Newcastle.

It must be remembered, too, that the climatic conditions of the English and the south Italian life are entirely different. The English climate is too temperate to require any general provision of swimming baths, and in Newcastle itself the days in each year hot enough to make a cold swimming bath really enjoyable may probably be numbered on the fingers. Advocates of these public baths insist on their utility as providing opportunities for learning swimming, and this would no doubt be true if the children of our Board Schools were taught swimming compulsorily. As it is, I very much doubt whether the results in this direction are at all commensurate to the outlay involved; and many people believe that the numbers of those who know how to swim have not materially increased since the introduction of swimming baths.

Experience has shown us in Newcastle that they are ill-supported and therefore presumably not required. The object at which we should aim is rather, I think, the introduction of the bath into each individual house. For all practical purposes this will suffice; and, above all, it will give the working man an opportunity of taking a warm bath when he comes home from his work tired and dirty (and our industries in Newcastle are for the most part dirty industries), at a time when he most needs it and when it is most refreshing. Almost every house with any pretentions to ordinary comfort now building is being fitted with a bath, and until baths can be introduced into those houses* already built, establishments should be provided in all the industrial neighbourhoods where the workman could obtain a warm bath with the utmost degree of comfort and the minimum of cost. Such bathing establishments need not be large or costly—existing buildings could be readily adapted to the purpose—but their number should be multiplied so as to enable a man to get his bath without going far afield. Something has been done in this direction by the provision of separate baths as an adjunct to the swimming baths, and they have proved fairly useful. But the price, though low, is not low enough, and at best they are a poor substitute for the bath in the house; because, for one man who will take the trouble to go to a bathing establishment, ten would bathe at home if they had a bath under their own roof.

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* This is rapidly being done.

The bath in private houses is, after all, no novelty in this country. Our Roman ancestors fully appreciated its advantages, and, wherever the remains of their villas are found in England, it is ten to one that the bath is distinguishable. These baths are almost always on a very complete and elaborate scale, and in some of the larger villas in the South of England a suite of bathing apartments was provided not only for the masters but also for the servants. Though Roman life in its most luxurious aspects seems not to have extended further north than York, or rather Aldborough, and though the occupation further north partook of an exclusively military nature, and no pleasure houses with frescoed walls and tesselated pavements are found in Northumberland, yet the baths are found. It was the one luxury, it seems, with which the Roman soldier could not dispense, and which he introduced into the most unlikely situations.

I have been led much further from my subject than I had intended, and must return to it by repeating that increased facilities for bathing imply a correspondingly increased water supply. The ordinary bath in a private house uses, perhaps, twenty or thirty gallons of water, a medium-sized swimming bath from 50,000 to 75,000 gallons. The fixed bath in houses, the common use of water-closets, the more perfect flushing of sewers, the more frequent watering of roads, the more general employment of hydraulic machinery, all mean more water.

With this increasing demand the Newcastle and Gateshead Water Company has done its best to cope. The growth of the water supply of a large town is, I think, in some ways an index of the growth of its civilisation; and you will pardon me if I venture to give you a very brief outline of the history of the Newcastle water supply, because the figures are interesting as indicating what I venture to think is an unusually rapid development.

The first attempt to supply water was here, as elsewhere, confined to those public fountains which, with their gossipping groups of water-drawers, formed so striking a feature of mediæval life. The growth of the town rendered it painfully obvious that some more copious supply was necessary, and at the end of the seventeenth century (1697) an Oxfordshire man, named Yarnold, stepped into the breach with an offer to the Corporation to "convey good and wholesome water to all parts of the town where required, in sufficient quantity for the uses and occasions of the inhabitants" during a period of 300 years, in return for a lease securing him the monopoly. It was a bold undertaking, but the Corporation accepted his offer gratefully enough.

Yarnold utilized a spring which had been tapped in an old colliery at Coxlodge. His main reservoirs were at Holmes Close, Gateshead, and the water was conducted to them from Coxlodge by a four-inch pipe laid across the moor. This pipe was of wood, and second-hand when laid down, for Yarnold had picked it up cheap in London. To get to the Holmes Close reservoirs, the pipes crossed old Newcastle Bridge, and the water supply for Newcastle itself was led back again across the bridge by a three-inch lead pipe. In winter the water supply was tolerably adequate, but in summer it constantly failed and had to be supplemented by water pumped from the river at Sandgate.

The water was delivered to a single tap in each street, and those who paid for the privilege had at first keys which gave them access to it. The elevation of the Gateshead reservoirs was slight, and the higher parts of the town could not in consequence be supplied at all. Yarnold disposed of his waterworks and monopoly to a small syndicate of sixteen persons, who formed a joint stock company. They increased their water supply by turning pipes from some springs at Heworth into the Gateshead reservoirs.

The system of service was a little complicated. From the Gateshead reservoirs two large leaden cisterns in Newcastle were filled three times a week, and from the leaden cisterns the various districts of the town got on one day of the week a few hours' service. During this weekly service period the tap in each street in a given district was supplied with water. Some districts had a supply of six hours once a week, some five, some four, and some of the smaller ones only two. The inhabitants of each street took good note of the time at which their tap was running, and by dint of hard work carried enough water in that interval to fill the large domestic cistern with which each house had to be provided. This cistern in each house was supposed to contain enough to keep the house going until the time came round for the street tap to give its weekly dole again. In winter the water company gave two weekly services, and sometimes three.

It seems a curiously inefficient system, but it answered its purpose amid much grumbling (but what water company is not a mark for grumblers?) till the eighteenth century was well advanced. But in 1776 one Ralph Lodge, with some co-partners, in an address presented to the Corporation, refers to the inadequacy of the supply, and offers himself to furnish water to "every inhabitant upon all occasions and emergencies in the most ample manner." This offer was contingent on the City authorities granting him a lease of some of their springs. The Corporation was in some doubt as to which of the springs had the best water from a sanitary point of view, and there were strong advocates found for a supply from the Tyne, from the Coxlodge spring, and from more than one other source. Eventually analyses were ordered to be made, and Dr. Rotherham, a Newcastle pedant, published a volume on the subject, entitled "A Philosophical Inquiry into the Nature and Properties of Water." It is of great length and very dull, but some of his experiments would astonish the modern analyst. His most crucial experiment was to evaporate a gallon of the Coxlodge water, then to take thirty grains of the residuum and administer it in oatmeal balls to a very young chicken. The innocent bird was kept a whole day in the analyst's study without exhibiting any evil symptoms, and, being fed afterwards with the other chickens of the same brood, was served three weeks later for the doctor's dinner. "It appeared upon the table to be equally fat and in good condition." After such conclusive proof of excellence it is no wonder that the Coxlodge source won the day and the Tyne was for the time driven off the field. So Ralph Lodge and his partners were granted a 227 years' lease of a piece of ground at the south of the moor on which to make reservoirs to store the Coxlodge water which had supplied Yarnold's pipes.

In 1797 Lodge's works were purchased by the Newcastle Fire Office, and in 1805 a shaft was sunk by them near the Grand Stand in the hope of obtaining additional water supply. These hopes were more than realized. An immense body of water was tapped in some old pit workings into which a stream empties itself, and disappears from the surface a little west of Coxlodge Farm House. A windmill was then erected to pump, and this new water became the recognised supply for Newcastle as the Heworth springs continued to be for Gateshead. Yarnold's springs at Three Mile Bridge were no longer required, and fell into disuse. The water wheels and pumping machinery were removed, and the elm wood pipes taken up for the most part, though an odd one is still found now and again in digging operations. Thus Yarnold's name fell into oblivion with his works, but it deserves to be occasionally recalled to memory; for the bold Oxfordshire man's attempt was the direct ancestor of the Newcastle Water Company of to-day.

So effective were the measures taken by the Fire Office Company in 1805, that the water supply then obtained needed no supplementing for a quarter of a century. But in the autumn of 1831 Asiatic cholera landed at Sunderland, and in the summer of the next year appeared in Newcastle. Personal cleanliness and frequent washings of the streets were preached as preventives. There was a panic, and the reservoirs of the water company were severely taxed. The winter of 1831 had been unusually mild and rainless, and at the moment of trial the water supply broke down.

So an opportunity was afforded for competition, and in 1833 a new water company came on the scene. It was called the Subscription Water Company, and had a capital of £20,000. The system of this new company consisted of a pumping engine on the Tyne about a mile above Newcastle, filter beds, and a new reservoir built on Arthur's Hill 240 feet above the Tyne. These works were pushed to completion, and came into operation in November, 1835. So Newcastle had for the first time two water companies. Competition was very sharp, and brawls between the workmen of the rival companies not unfrequently enlivened the monotony of the streets. But this state of affairs was of short duration, for in 1836 the older company gave way and sold all their works to the Subscription Company for £16,000.

In 1801 the population of Newcastle was 28,000; in 1821 it had increased to 35,000, but in 1841 it was 70,000. The Subscription Water Company seems to have done a good deal to keep pace with the growth of population; but they hardly grasped the situation, and in the beginning of 1845 a very formidable rival threatened them.

This was a company formed to supply Newcastle with water from a reservoir in Whittle Dene, about 13 miles from Newcastle, where the water of the Whittle Burn was collected by damming. The formation of this company was due to Lord Armstrong, who not only suggested the works but in the early years of the company gave it his powerful support. As the Fire Office Company had given way to the Subscription Company, so the Subscription Company in its turn gave way and sold their undertaking to the Whittle Dene Company for £55,000.

This last association finished their works in 1848. Five large reservoirs were formed in Whittle Dene with a capacity of 215,000,000 gallons, and Newcastle was supplied from them by a 24-inch pipe. This was the first really comprehensive scheme, and it would be useless for me to trace in any detail the development of the water supply further from that time to this. It is merely the history of occasional failures of water and consequent grumbling, of an earnest endeavour on the part of the company to keep pace with the extraordinary growth of the town by adding reservoir to reservoir, and of the gradual elimination of Tyne water from the company's system except for manufacturing purposes. Still, a few figures are instructive. In 1848 the reservoirs contained 215,000,000 gallons, and the daily water consumption was 1,500,000 gallons.

In 1857 the storage capacity had increased to 525,000,000 gallons, and the consumption to 3,250,000 gallons a day. In 1868 the consumption was 6,000,000 gallons, and in 1876 8,250,000 gallons a day. The consumption has recently increased at the rate of 500,000 gallons a day each year until it is to-day about 16,500,000. The population supplied by the company is about 400,000, and the present storage capacity is 3,065,000,000 gallons. Large as our reservoirs are they have proved insufficient, and an additional reservoir is in process of construction on the Rede which will bring the storage capacity to over 5,000,000,000 gallons.

If our houses present a great contrast with those of my youth in bath accommodation, they present an equally favourable contrast in their arrangements for dealing with sewage. The water-closet of former days was an evil thing, with complicated gear which was constantly getting out of order, and so boxed in with wood that it could not readily be got at. In most cases, it was a disseminator of foul gases through the house, and a fruitful source of disease. How familiar an experience it used to be for such of us as have had large families to find some of the household ailing, and on sending for the doctor to receive the gratifying assurance that something "was wrong with the drains." And then the house had to be pulled to pieces in the search for defective traps and leaks in inside soil pipes. No care could insure the proper working of the defective appliances which were all that we then had at command, and it has been pointed out that the typhoid which scourged the highest and wealthiest families in the kingdom, was probably attributable to the fact of their sleeping apartments being fitted with such places in close proximity. Now-a-days, all is changed. If the cry of "something wrong with the drains" is sometimes heard, it is heard much less frequently; and an outsider like myself cannot fail to be struck with the evidences of anxious attention and clever design exhibited in these commonplace but very necessary appliances. The earthenware fittings, admitting of scrupulous cleanliness and immediate access to all the gear; the ample flushing arrangements, the soil pipes outside the house, the ventilation by what a poetic friend of mine calls "the soaring drain-pipe pointing silently to heaven," the open trapping of sink and bath pipes, all tell the patient householder that his interests are being carefully watched by the sanitary engineer, and I assure you the householder is not ungrateful.

If the improvements in bathing accommodation and in the appliances for disposal of house sewage are among the most remarkable domestic efforts of the sanitary engineer, there are other directions in which his skill joined with that of the architect has proved equally successful. In such matters as ventilation and warming enormous progress has been made. Warming with hot water, which is more or less of a luxury in the south of England, is in this colder climate almost a necessity if large houses are to be maintained in winter at a comfortable temperature. Wall papers, cooking ranges, beds, are all topics which tempt one to speak further: and mentioning beds, reminds me of the enormous improvement that has, during my lifetime, been made in the sleeping accommodation of an average house.

In even the largest houses of a former date everything was sacrificed to the so-called reception rooms. The sleeping accommodation was altogether starved: the bedrooms for the family were small and ill-ventilated, and those for the servants disgraceful. One often wonders in looking through well-known houses of the end of the last century and the beginning of the present, how the large gatherings of friends that certainly took place there were ever accommodated. Such houses seem large enough outside, but when it is attempted to allot bed-rooms to visitors, the bed-rooms are found far too few and with some exceptions far too small for modern requirements. I fancy that the explanation of such anomalies is that our ancestors were content with very modest washing accommodation, and that in the case of men at least, and probably of ladies too, each bedroom on occasion did duty for several occupants. A mattress on the floor, or any other "shake-down," was as much as an ordinary bachelor or spinster expected on a country visit at Christmas or other generally festive season.

I remember a passage in George Eliot's "Silas Marner," describing the heroine's visit at Christmas to the squire's house, which I venture to quote:—"There was hardly a bed-room in the house where feminine compliments were not passing, and feminine toilets going forward in various stages, in space made scanty by extra beds spread upon the floor, and Miss Nancy as she entered the blue-room had to make her little formal curtsey to a group of six." In Miss Burney's "Evelina" two daughters of a well-to-do silversmith, are driven to dress somewhat hurriedly in the drawing-room before their guests arrived.

As for the servants, they slept as they could, huddled together in tiny rooms, in cupboards, in the space under the stairs, in box-rooms, or in any other recess that would contain a mattress. The country houses of Northumberland, so far as I have had opportunity of judging, were bad in their servants' accommodation, though I have no reason to think that they are worse in this repect than those in other counties.

Modern practice has greatly improved these matters, and a much better balance is now observed between the living and sleeping rooms of a large house. I am inclined to think that we err, if anything, in devoting too much attention to our sleeping rooms, and are carrying a good theory to a fad in demanding that they should be so spacious and so elaborately furnished.

In conclusion, I would say that though the details of sanitary improvement seem often petty or commonplace, we should not therefore be led to think them unworthy even of master minds. The general result is as vast and far reaching as the details out of which it is built up are trivial and unromantic. Who shall say that a vast field is not open alike to the man of science, to the physician, and to the philanthropist, when he reads a passage like the following:—

"The probable length of life varies extremely in different surroundings. In Switzerland it is at birth 41 years, in England 28, in France 21. But in Paris it is only 8 years, in London 3 years, in Berlin 2 years, and in Vienna less than 2 years. Such is the tax levied by our great enemy Death on the misery and the immorality of our great towns, and the tax is paid, almost entirely, by the rising generation."

It is more than 50 years since this passage was written, and I regret that I am not in a position to give similar figures for the present day; there is always great difficulty in making accurate comparisons of this nature because the tables from which the figures are derived, are not always obtained by identical methods. In England, I believe, the probable length of life has risen from 28 to 45 years, and doubtless in the other localities named, a great improvement has taken place, but though much has been done to improve the conditions of life, much yet remains to be done.

But I draw your special attention to the passage I have quoted because, as you will have observed, the difference in the probability of life between town and country is enormous. The less a population dwells in towns, the greater at birth is the probability of life. In Sweden for example, the probable life at birth is 51 years.

Lord Percy, in his most suggestive address, drew our attention to the continually decreasing population of the country districts, and to the continually increasing population of the towns. I confess that this important subject does not appear to me to receive the attention it merits. To adults, no doubt, it makes little difference whether they live in town or country, but the figures I have quoted show the effect on the death-rate of the young. Death, too, is not the only evil. Enfeebled constitutions and loss of physique—in time affecting the whole race—are the infallible consequences of placing a large majority of the young in the midst of unhealthy surroundings.

There is one other subject to which I feel it to be a duty to call your attention. It was alluded to in some weighty remarks which fell from his Royal Highness at your opening meeting. My recent journey in the East brought me in contact with men who have convinced me of the magnitude of the evil. An evil which saps the efficiency of the British Army in India, and permanently injures the health of a large portion of the rising generation, is surely a proper subject for the enquiry of the highest sanitary authority in the kingdom.

Politicians can, I fear, hardly be expected to move in the matter, unless their duty is made plain to them by such a body as I have now the honour of addressing.

It was the fashion among schoolmen to divide knowledge into two classes—Human and Divine. You and I, gentlemen, will admit of no such arbitrary distinction. To us all knowledge is Divine, and never more Divine than when it is busied with the effort to lessen, however slightly, the sum of human misery, or to increase, however slightly, the sum of human happiness.

For the sake of those to whom knowledge must offer earthly inducements, I add: Length of days is in her right hand—in her left are riches and honour.

At the conclusion of the address Earl Percy said, I have great pleasure in moving a vote of thanks to Sir Andrew Noble for his very interesting address to-day. I won't detain you with any remarks upon it, first of all because I am not qualified to do it, and in the second place because my breath has been rather taken away by one part of it. But it really seems to me Sir Andrew Noble has sketched out a probable state of things in which we shall have no rivers at all, and all the water will be contained in the reservoirs of the water companies. As I am not a fisherman that will, perhaps, not affect me as much as it will others, but, perhaps, the fishermen will profit by the warning received.

Mr. A. Wynter Blyth (London): I have much pleasure in seconding. One thing has struck me, and that is the grasp of the whole subject that Sir Andrew Noble has obtained. He disclaims being an expert, but I think his address justifies that title as applied to himself. With regard to public health generally, that has been advanced by the united efforts of many sciences, especially by the science of medicine, by the chemist, and by the engineer. When the theories of the two first named sciences require practical application we have to call in the engineer; to him therefore we owe a great debt.

SECTION III.

CHEMISTRY, METEOROLOGY, AND GEOLOGY.

ADDRESS,

BY W. H. DINES, B.A., F.R.Met.Soc.,

PRESIDENT OF THE SECTION.

CLIMATE.

A BRIEF ACCOUNT OF THE VARIOUS CAUSES THAT PRODUCE IT, AND ITS EFFECT UPON THE AVERAGE LENGTH OF LIFE.

OF the many separate elements that make up the climate of a place, temperature is the most important, and the mean annual temperature depends primarily upon the amount of radiant heat received from the sun. All parts of the earth's surface receive heat and all radiate heat into space, and since the temperature of the earth is not changing at any perceptible rate, the heat so radiated must be exactly equal to the heat received. But while this statement is strictly true of the earth taken as a whole, it is only partially true of any particular locality, since heat received from the sun in one place may be conveyed by winds and ocean currents to another; and thus we find that the position of a country with regard to the large oceans and land areas, and the direction of its prevailing winds, has a bearing upon its climate, next only in importance to its latitude.

Roughly speaking, the sun is shining upon the upper surface of the clouds for the same number of hours in the year at all parts of the earth's surface, though the amount is rather less in the southern hemisphere on account of the shorter summer season. But if a globe were placed at the upper limit of the clouds it would receive exactly the same yearly amount of heat at whatever part of the earth it might be, the shorter summer of the southern hemisphere being compensated by the greater nearness of the sun at that time. Hence it would appear that all parts of the earth should be equally warm, but such is not the case, the reason being that the same quantity of heat received from the sun is concentrated upon a small surface when it falls near the equator, and is spread over a large surface when near the poles. To obtain a clear conception of this important fact, let us consider the sun's rays falling upon a given area, say a drawing-board containing an area of one square yard. This board will receive the greatest possible amount of heat, if it be held so that the rays fall perpendicularly upon it. At either equinox on the equator at noon, the board so held will shade one square yard of surface, and the heat received by the board will be just the same as that received by one square yard of the earth's surface anywhere in the same locality. Suppose the board removed to a place in latitude 60°, and held perpendicularly to the sun's rays: it now shades two square yards of ground, and thus receives the same heat as any two square yards in the same locality. But the actual heat received by the board would be the same in both cases were none of the sun's rays absorbed by the air. Thus the surface of the earth in latitude 60° receives in spring and autumn only half of the heat received near the equator, and although the proportions are very different in the summer or winter, on the average for the year about this fraction is maintained, and hence we have the marked distinction between the climates of the tropics and of the arctic circle.

The difference is about 55° F., the mean temperatures being about 80° in the tropics and 25° in latitude 60°. This would be far greater than it is were not a large amount of heat carried away from the tropics by ocean currents, and to a lesser extent by winds, and distributed over the temperate and arctic regions.

The following table, showing the amount of heat received from the sun at various times and places, is copied from Prof. Davis' "Elementary Meteorology":—

Latitude	0°	20° N.	40° N.	60° N.	90° N.	90° S.
March 21st.	1·000	0·934	0·763	0·499	0·000	0·000
June 21st.	0·881	1·040	1·103	1·090	1·202	0·000
Sept. 22nd.	0·984	0·938	0·760	0·499	0·000	0·000
Dec. 21st.	0·942	0·679	0·352	0·000	0·000	1·284
Annual Total	347	329	274	197	143	143

In this table the insulation, or amount of heat received from the sun, on March 21st on the equator is taken as 1·000, this being the unit in which the other values are expressed.

From it we note that for a short time at midsummer the North Pole receives more solar heat than the equator, and also that the greatest daily supply of heat to any part of the globe occurs on December 21st at the South Pole, this result being caused by the greater proximity of the sun and earth in our winter.

The mean annual temperature is not the only way in which the climate of a place depends on temperature, the difference between summer and winter is also important. In general, places within the tropics have but a small variation of temperature, and islands placed in the middle of the large oceans, whether in the tropics or in temperate latitudes, have a summer and winter that are much alike. Thus Bombay has about 15° F. difference between the hottest and coldest month, this also being nearly the range for the Land's End and the Scilly Isles. To find great differences of temperature between the seasons, we must go to the interior or eastern sides of the great continents, thus the summer in the central and northern plains of North America is some 70° or 80° hotter than the winter; and a district in the north-east of Siberia is credited with a range of 120° F., the July mean temperature being given as 60° (about the same as England), while the January mean attains the almost incredibly low value of −60° F.

In this district in February, 1892, the lowest natural temperature ever recorded occurred, viz., −93·6 F., and the mean for February has been as low as −72·0. These great differences exist in places which are entirely dependent upon direct heat from the sun, and receive no heat from warmer climates by winds or ocean currents; they can only occur in inland places. Six months does not give sufficient time for a large mass of water to change its temperature to any great extent, partly because the specific heat of water is very great compared with that of other substances, and partly because the currents produced by winds, and perhaps tides, render it impossible for the surface alone to change its temperature, and thus any alteration extends to a considerable depth. On the land it is the surface alone that is affected by the change of seasons. At Greenwich, at a depth of 25 feet, the variation is only about 3° F. The frozen sea of the polar bason acts in winter somewhat like the land, but in summer no temperature much above 32° F. can be attained until the ice is melted.

Were the land area of Asia carried across the Polar Sea so as to join Greenland and North America, we may safely say that there would be a short but hot summer at the pole, for the snowfall of such a region would be light on account of its situation, and the snow once melted in the spring, there would be nothing to check the solar insolation producing a high temperature. As it is, in latitude 60° throughout most of Europe and Asia, there is a summer temperature of 60° F., and this is lower than it would be but for the proximity of the polar ocean. This speculation is interesting as showing the way in which geological change may influence climate, but I can conceive of no distribution of land and water, which could have produced the glaciation of the British Isles, while the Atlantic

Ocean remained to the westward, and the axis of the earth retained its present position.

The British Isles, and the Western Coast of Europe generally, present the most marked example of a climate differing in temperature from the value we might expect from the latitude. There seems to be a remarkable concurrence of separate causes, each of which tends to make the winter temperature high.

As previously stated, the greater portion of the sun's heat which falls upon the earth, falls upon the equatorial regions, with the result that the temperature of the air and surface water within the tropics is maintained at about 80° F. Near the poles the temperature of the sea falls to 30°, and that of the air to zero or even lower. The inevitable result is a circulation of both air and water between the two parts, a circulation which is comparatively simple so far as the ocean is concerned, but the details of which are extremely complicated when we consider the air.

Roughly we may compare the process to the warming of a house by hot water pipes, but here we have a large space, namely the tropics, in which the fluid which carries the heat is warmed, and the separate streams of warmed air or water converge as they pass toward the poles.

The element however which is most important is the earth's rotation, for in consequence of this a body moving on the surface of the earth tends in the northern hemisphere always to turn towards the right hand, instead of going straight on, and in the southern hemisphere to the left. This action gradually changes a westerly wind or current into one blowing from the pole, and this again is changed by the same cause into an easterly one. The result in the North Atlantic Ocean is the large circular swirl, the northern and western sides of which produce the well known current of the Gulf Stream. The same causes, namely, the heating of the air in the tropics, the cooling round the poles, and the deflective action of the earth's rotation produce all the prevailing winds of the globe; and the manner in which this is done has been elucidated by the late well known meteorologist Ferrel, but is much too complicated to be briefly explained. The general result may be stated as follows:—There is a belt of calms roughly coinciding with the equator, the region of calm being the part where the sun's heat is greatest, and where in consequence the air is ascending. This is a region of heavy rainfall. On each side the prevailing winds are easterly, and as we recede further from the equator, either north or south, the winds become N.E. or S.E. (An exception to this occurs in the summer in the Indian Ocean, where the

S.W. Monsoon prevails from June to October). The belt on each side of the equator lying in about latitude 30° is a region of light winds and of little rain. Further away still, that is in the temperate latitudes of both hemispheres, the prevailing winds are westerly, and it is to this fact, more than to any other, that the mild climate of the British Isles is due. The above description is only a general one, and there are several local exceptions.

In the Southern Ocean the westerly winds prevail with great regularity throughout the year, but in the North Temperate Zone the effect is modified by the two oceans and continents they pass over, the winds being at some times and in some places S.W., and at others N.W. Still throughout the year the winds are in general from some westerly point. The Atlantic and Pacific Oceans have a comparatively uniform temperature, from which the westerly winds after passing over them cannot differ much, and thus the western shores of Europe and North America have a fairly equable climate. In addition to this their mean yearly temperature is above the mean for their latitude, because the sea-water is above its proper temperature on account of the circulation bringing warm water from the tropics.

A striking result occurs in England, where the mean winter temperature is from 30° to 40° F. above the mean of the earth's surface in our latitude. In England too we have a subsidiary local cause which raises the winter temperature.

The prevailing wind in Western Europe is westerly, but anyone who watches the flow of a river may notice here and there eddies, in parts of which the water is apparently moving up the stream. It is similar eddies in the general motion of the atmosphere which produce our easterly winds. Generally, even when the surface wind is from the east, the upper current, as shown by the cirrus cloud floating in it, is from the west, and if we could identify the actual particles of air which pass over us with an easterly wind, I have little doubt we should find that most of them had come quite recently from the Atlantic Ocean. Still an easterly wind, though it is only local, does lower our temperature in the winter and raise it in the summer.

From causes into which there is not time to enter, the eddies, or cyclones, or depressions as they are called, generally move from S.W. to N.E. along the Irish and Scotch coasts, and since the earth's rotation makes the air in them always go round in the same direction (*i.e.*, opposite to the hands of a clock in the northern hemisphere), the position of the usual track of these cyclones intensifies the strength of the south-westerly winds over England, and also causes the prevalent direction to be more from the south, thus again raising the temperature. On the rare occasions when the track of the cyclones is across France or Spain, we have a local easterly wind, and a much colder winter.

What our climate would be were the prevailing winds really from the East we can see by noting the climate of Labrador and Eastern Asia, places which have the same latitude as England, but where the prevailing winds are from the land instead of from the sea, and which in consequence have a winter mean temperature below zero.

There is one other point which influences temperature, and that is the altitude above sea-level. This is of extreme importance to us English, because in India and in Central Africa there are on this account small areas in which Europeans can live and to some extent recruit their health, the temperature being reduced to a more bearable degree by the altitude. If we confine some air in a vessel, and then allow the enclosed air to expand suddenly, we find invariably that after its expansion it is cooler than it was before. If we could obtain a vessel, through the sides of which no heat could pass, the expanding might be done slowly or quickly, and in either case the fall of temperature would be exactly the same. This process is called dynamic cooling, and its importance in meteorology cannot be over-estimated. Air, as it rises from any level to a higher one, becomes less compressed, because the weight of the air above it is less, in consequence it expands and cools. Conversely as it descends it is compressed and warmed. The amount of cooling for a given change of pressure admits of exact determination. By theory, using the value of Joules' Mechanical Equivalent of Heat, or by direct experiment, we find that air, the pressure of which is lowered by one inch of mercury, falls about 5° F. in temperature, and thus a dry wind blowing up the slope of a mountain 1000 feet high, would, if it gained no heat from contact with the slope, reach the top some 5° F. cooler. It is on this account that temperature decreases with altitude, and from a large number of long continued observations, it is found that the decrease is 1° F. for about every 300 feet altitude. The sea-level temperature in the tropics is approximately 80° F., hence to obtain the mean annual temperature of a tropical sanitorium, we only have to divide the altitude above sea-level by 300, and deduct the number so found from 80°; the result is not far from the mean temperature.

There are other important elements of climate beside temperature. From a health point of view humidity is perhaps the chief. In general a climate in which the seasonal variations are slight is a moist one, because all the water vapour in the air comes originally from the sea, and proximity to the sea produces both an equable and moist climate. Within the tropics there is, as a rule, a wet and a dry season, the wet season occurring when the sun is overhead. At places near the equator this sometimes leads to two wet and two dry seasons in the same year. Rainfall and relative humidity must to some extent go together, but the place which has the greatest rainfall does not of necessity have the highest relative humidity.

Rain, or at least heavy rain, is invariably associated with a rising current of air; it does not matter whether the upward current is produced by the sun's heat warming the earth's surface, and hence the air in contact with it; or by a prevailing wind being tilted upwards as it passes over a range of mountains. The former cause produces the wet seasons of tropical lowlands, but the latter is responsible for most of the heaviest rainfalls in the world.

If we attempt to establish any fixed relation between climate and health, we are met by considerable difficulties, but there can be no doubt that climate has a most important bearing upon health. Of course we must exclude tropical countries from the first part of above statement, for such countries are proverbially unhealthy; in fact, few Europeans can live in them for any length of time, and the average length of life of the natives is not great. The most unhealthy climates are those of sea-coasts near the equator which have an average temperature of about 80°, with a high relative humidity, and where the thermometer never rises much above 90° or falls much below 70°. Although the inland parts of tropical countries are not as bad as the coasts, yet, so far as I am aware, there is no district of any size within the tropics that can be called healthy. It is often stated that the central highlands of Africa have not a bad climate, but this statement is generally made where the context shows that a comparison is being drawn between it and that of other tropical lands. Mr. C. H. Robinson gives the death-rate for Europeans on the western tropical coast at 150 per 1,000. If the rate in the centre be double that of England, it is still hardly one-quarter that of the coast, and it is not surprising that a traveller, after running the gauntlet through such a region, should call the interior healthy.

There is very great difficulty in getting reliable information as to the healthiness of any particular country. Travellers or residents are probably influenced by their like or dislike for the place in question, though doubtless this influence is unconscious, and their statements are often contradictory. No one can form a good idea of a climate until he has lived in it for some time, and life is not long enough for one man to have personal experience of many climates. Where there is a general consensus of opinion, as in the case of the tropics, we need not doubt that the nearly universal belief is right, but for some places it is very difficult to find out the truth. Again, opinions as to what is healthy or unhealthy differ greatly. We are now apt to think that the east wind is not good for us. In Shakespeare's time it was the south-west and south that had a bad name, for in the Tempest, Caliban curses Prospero by wishing among other things "a south-west blow upon ye," and in a book published in 1582 the following passage occurs: "southern winds corrupt and destroy, they heat and maketh men fall into sicknesse."

Statistical tables of mortality are free from the objection of personal bias and afford the only reliable information as to the effect of climate. It has been said that figures will prove any thing, but it is a statement with which I do not at all agree. The death-rate of a city or district depends upon a large number of independent elements, of which climate is one, and it is difficult to disentangle the separate elements and see how much is due to climate. No doubt by carefully selecting his figures, a person might support almost any inference he pleased as to the relation between climate and health, but the mere fact that the figures had been selected, or the period dealt with had been too short, would deprive the result of any just claim to the title of proof. Again in dealing with statistics even when taken for a long period, and without any selection, certain differences in average values are pretty sure to appear in accordance with the law of probable error. Take rainfall returns as an example. For forty-six consecutive years in the London district, which my father tabulated, the average rainfall for May 29th was ·104, but for May 30th it was ·027. Taking three consecutive years of my own daily rainfall register, I found that the rain that fell on the Tuesdays was nearly twice that which fell on the Sundays. Now no sane person can suppose that there is any physical cause for May 29th being nearly four times as wet as May 30th, or for Tuesday being wetter than Sunday. In both cases some such result would be expected from a study of the theory of probability, and it is due merely to the accidental occurrence of heavy rains on the one day, and their equally accidental absence on the other. Hence in dealing with mortality statistics, we must be careful that the population dealt with, and the period taken shall both be large enough to eliminate, or rather to render unimportant, any accidental anomalies. Thus in a town of say 5,000 inhabitants, the death-rate in one year is quite likely to be double or even treble that in another, and averages based on a long series of years are necessary before we can compare the healthiness of two such towns; but take two countries, say England and France, and the returns from year to year will always bear a fairly constant ratio to each other.

Temperature is by far the most important climatic factor in the matter of health, but may be in some cases of less importance than many other matters which have no connection with climate. Sanitation and a good water supply, the habits of a people, and probably the race to which they belong, must tend to influence the average length of life. It has been suggested that the higher death-rate of a city is due, not to the impurity of the air, but to the fact that the occupation of city people mostly keeps them indoors, whereas in the country it keeps them out of doors. The suggestion seems very probable, and before we can feel sure that the difference of the death-rate in two countries is produced by any special one of the above causes, we must know that it is not due to some one or more of the others. From all accounts the sanitary state of London fifty years ago was nothing to boast of, but the average death-rate for ten years has never exceeded twenty-five per thousand. Liverpool at the present time must surely be in a better sanitary condition than London fifty years ago, and yet the Liverpool rate last year was 28·8. To what are we to attribute this difference between London and Liverpool?

There are three ways which occur to me by which we may test the influence of climate on health. Firstly, by taking the death-rate in various districts, and seeing if we can find any relation dependent on climate. Secondly, by the returns for the British Army. Thirdly, by studying the variation in the death-rate for some large district from year to year, and seeing if any relation between it and the meteorological elements can be found.

TABLE I.

	Mean annual temperature.	Death-rate.		Mean annual temperature.	Death-rate.
Edinburgh	46·4	19·3	New York	51·4	25·9
Christiania	41·6	19·3	Rome	59·7	26·3
London	50·3	20·9	Vienna	48·8	26·5
Geneva	49·2	22·0	Dublin	48·8	27·2
Stockholm	41·7	22·1	Calcutta	78·3	28·7
Copenhagen	45·4	22·8	Bombay	79·4	31·9
Brussels	50·5	23·8	St. Petersburg	38·7	34·7
Amsterdam	49·0	23·2	Madras	81·7	44·9
Paris	50·8	24·6	Cairo	71·2	49·7
Berlin	48·5	25·2			

The temperatures are taken from Buchan's "Report on Atmospheric Circulation."

Table I. gives the death-rates in nineteen large cities, the figures being obtained from the Registrar-General's returns. To avoid any selection which might prejudice the result the cities which are the capitals of their respective countries have been taken; and with the exception of Cairo, the rates are all averages of at least twelve years, most of them (London included) being eighteen years, but Cairo only eight years. Alexandria however has a fifteen years' average of 41·9, so that we may accept the Cairo figures as correct. These include every capital with a sufficiently long record that I could obtain from the Registrar's returns. A glance at the Table shows the connection between latitude and health, the most northern and coldest cities being by far the healthiest, and the southern cities the least so. St. Petersburg, Cairo, and Dublin are exceptions. Of St. Petersburg I know nothing, but Cairo is notoriously unsanitary. The climate of St. Petersburg is like that of Canada, which is certainly healthy, but the climate of Egypt is very hot, and may be called tropical. However, exceptions are sure to occur in a Table of this kind, and we have no means of eliminating the other elements and seeing how much is due to climate alone.

It is satisfactory to see London and Edinburgh appear so high in the list, and it is worth noting that the two best cities, Christiana and Edinburgh, are cities in which the monthly temperature hardly ever exceeds 60° F.

TABLE II.

	Average death-rate per 1000 during the years 1882 to 1891.	Mean annual temperature.
Canada (Halifax)	5·09	42·6
United Kingdom	5·73	49·0
Gibraltar	6·03	65·2
Malta	8·18	66·6
South Africa	8·58	65·0
China	9·75	75°
Ceylon	12·38	80°
India	14·73	80°
Egypt (Cairo)	23·78	71·2

Table II. is taken from the Army Medical Reports verbatim, the order only being changed, and the stations at which the average strength is under 1000 being excluded. The rates are averages of ten years, 1882—91, excepting that for Egypt.

This Table is not open to the same objections as Table I., for the figures refer to men taken from the same race and housed in barracks, the sanitation of which is under the same general supervision. Thus the one element which varies in climate, and we cannot escape the conclusion that the variation in the rates is chiefly due to climate.

The averages given for Egypt vary in a manner I cannot understand. For the seven years 1883—89, the rate is given as 25·66. For the eight years 1883—90, it is 28·80; and for the nine years 1883—91, it is 23·78. These figures contradict each other, but agree in showing a very high death-rate. For the three years 1890—92, the average is 11·30. For South Africa too the figures are difficult to understand, for the average for the ten years 1880—89, is given as 18·23, a higher rate than India. Still I think we may accept the table as substantially correct, because, except for Egypt and South Africa, the order in which the places stand is much the same whether we take a ten years' average or a three years' (1890—92) average. For the United Kingdom and India a three years' average is sufficient, but in the other places the number of men is not large enough to make it dependable. With the exception of Egypt, or including Egypt, if we take the value 11·30 the death-rate varies almost exactly as the temperature, the hottest country, India, coming at one end, and the coldest, Canada, at the other. Thus Tables I. and II. both lead to the same conclusion, namely, that between the limits of 80°—40° F. for the mean annual temperature, the colder temperature is the healthiest. We might perhaps have expected this result, from the well-known historical fact that a northern nation has almost always been the stronger, and in the long run conquered the more southern one. It would be well for us as a nation if we bore this in mind, for the annexation and colonization of tropical and semi-tropical countries must produce a considerable drain upon our national strength, and the increased commerce so obtained is, I think, often very dearly purchased.

The popular idea seems to be that South Africa has a good climate; indeed, I have seen it stated both of Egypt and South Africa that they have the healthiest climates in the world. These figures lead to the conclusion that out of the tropics they have the most unhealthy, for bad sanitation can hardly be the sole cause of the enormously high Egyptian death-rate, and we have no reason to suppose that the two South African stations at which troops are kept are especially insanitary. It would appear too as if dry heat were even more deleterious than damp heat, for Egypt has an extremely dry climate. It is satisfactory to find that the much abused climate of England is superior to that of any of her colonies in which troops are kept excepting Canada. Instead of Canada we should perhaps say Halifax, the only military station in Canada. Sudden changes of temperature cannot do much harm, for at Halifax the tables of daily temperature show that a difference of 25° F. between two consecutive days may occur three or four times in one month, whereas in England we should be unable as a rule to find as much as 15° difference once in a month.

With reference to the third method, I trust I may be pardoned for referring to a paper read by me before the Royal Meteorological Society. I examined the Registrar-General's returns for a period of thirty-two years, 1862—1893. At first I tried the weekly returns, but beyond seeing that in winter a decrease of temperature was often followed by a rise in the death-rate, could find no marked relation between any meteorological element and health. The quarterly returns were then taken, but the expected result as to cold in winter was not established. During the thirty-two winters between 1861 and 1893 the most unhealthy were on the whole those that had an average temperature. The figures are as follows: The winters with a temperature within 1° F. of the average had a rate of 0·40 above the average. Those with a temperature of 1° or more above had the rate of 0·24 below; and those with 1° F. or more below had a rate of 0·14 above the average. The departures from the average are so small, in no case exceeding 2 per cent, that we cannot build any theory upon them; they show only that there is no marked relation between temperature and health in the winter. Most people dislike cold, and I think the old proverb is often acted on here, "Give a dog a bad name and hang him." It is difficult to see why else evil effects should so often be ascribed to cold, which certainly cannot be proved from the Registrar-General's returns.

A rise of temperature in summer does not show immediately on the weekly returns, but curiously enough, if continued for any time, it has a marked effect upon the rate. In fact, the close connection between a hot summer and a high death-rate, and a cold summer and a low death-rate, was the only correspondence that a careful study of the quarterly returns enabled me to detect. The hot summers had a rate of 1·35 per thousand above the average, the average summers 0·13 above, and the cold summers 1·28 below. There was no positive exception to the rule throughout, that is, no instance of a hot summer and a low rate, or *vice versâ;* but the cold summer of 1882 had an average rate, and the average summer of 1881 had a decidedly low death-rate. The rule has been maintained since, the lowest quarterly rate (14·2) ever registered occurring in the cold summer of 1894. Also I have casually examined the returns for dates preceding 1862 and found no exception. This rule is very remarkable; it means that if the mean summer temperature be 62° F., 20,000 more deaths will occur during the quarter than if the temperature were 58° F.; or, to put it another way, a rise of 4° F. in the summer temperature causes an increase of 15 per cent. in the death-rate in England.

The three methods, briefly worked out above, all prove that a temperature below 60° F. is the most suitable for human life; and from Tables I. and II. it would appear that a mean annual temperature below 50° is the best. In Table I. the death-rate per 1000 per annum is remarkably near to half the mean annual temperature expressed in degree Fahrenheit, but this rule gives rather too high a rate for the Indian cities. In Table II. the military rate is very close to one-eighth of the temperature. If we change from the military to the civil urban rate by using the factor 4, a factor which is correct for the United Kingdom, we have the same rule as in Table I., but when applied here it gives too low a rate for the tropics. Table I. refers to natives who are acclimatised, Table II. to Englishmen, so that this difference in the tropics is just what we might have expected.

This is a very remarkable relation between the two quantities, and if we put the figures in the form of smoothed curves, the two curves would be practically identical. It is, perhaps, only a coincidence, but it is certainly a suggestive coincidence, that the rise of 1 per thousand in the death-rate should in each of the three methods accompany so nearly the same rise, viz., 2° F. in the temperature. But it is plain that the relation cannot hold for temperatures much below 40° F.

We have but little evidence to show what the relation between still lower temperatures and health may be. The English quarterly returns show an increased death-rate in winter, the average for the three months, January—March, being 21·7, and for July—September, 16·7. Examined more in detail we find a maximum occurring in August, the death-rate rising from May or June to August, and then falling again to October. The healthiest period in England is when the mean temperature is from 50° to 55° F. Other cities however, having much colder winters than London do not show the winter maximum, and we cannot ascribe it positively to temperature without first showing that it is not due either to the difference in the length of daylight, or to difference in people's habits. There are many who seldom or never take any outdoor exercise in winter, and this cannot be conducive to health.

Dr. Buchanan has suggested that a temperature of 32°—40° is the worst, and this agrees with the winter rise of the death-rate in England, and its absence in many countries where the mean winter temperature is below freezing. Certainly this temperature is particularly unpleasant, and is usually in England combined with gloom and damp fog. Still what is unpleasant is not necessarily unhealthy; in fact, the rule seems to be the other way.

No one can deal with the Registrar-General's returns without noticing the steady decrease in the death-rate that has been brought about by improved sanitation. The average for the last five years is slightly above that for the preceding five in England, but on the Continent the decrease has been well maintained up to the present date. This is shown in Table III.

Table III.

Average death-rate of the European Capitals (except Madrid) and Lisbon) for recent years.

1885	1886	1887	1888	1889	1890	1891	1892	1893	1894
24·1	24·5	23·9	23·1	22·7	22·8	22·2	No returns given.	22·2	20·6

The increase in England has been caused by influenza and diseases of the respiratory organs, which seem always to accompany influenza. The important question for us all, and particularly for this Congress, is, Can the rate be further reduced? I have not the advantage of speaking as a medical man, but personally I believe that by increased attention to ventilation, as much may be done to prevent diseases of the respiratory organs, as has been done by improved drainage to check the deaths from zymotic disease. The ventilation, or rather absence of ventilation, of public buildings, such as churches and chapels, theatres, &c., may well be called disgraceful to a civilised people. It is no exaggeration to say that there is not one church in 100 lighted with gas, the air in which would bear analysis with a satisfactory result half an hour after the commencement of evening service. Commonly no ventilation is provided. Sometimes only inlets are placed, sometimes outlets only, and as a rule the cross section of the air passages is ludicrously small. Still the size does not make much difference, for brown paper and paste are cheap and easily obtained, and it is seldom long before the openings, if any, are closed.

The fact that the majority are content to sit in these buildings without protest shows clearly that they are not altogether unaccustomed to breathing impure air in their own homes; and if, by any means, a greater love of fresh air, and a greater dislike to air overcharged with carbonic acid and organic impurity, could be imparted to all classes in England, there would probably be a very great decrease of infectious diseases (for fresh air is admittedly the best disinfectant), of diseases of the respiratory organs, and in the death-rate generally.

Earl Percy said, we have had a most interesting address, and I am quite sure you will wish to pass a hearty vote of thanks to Mr. Dines for his kindness in giving it to us. It is one that has covered a very large amount of ground, and if this was the time or the place, we might talk about it at some length. I will only make one remark, if I may be allowed to take advantage of my privilege in rising to move this vote of thanks. It is this. I should like to ask Mr. Dines, whether the rain-fall, as well as temperature, has not something to do with health. Mr. Dines has pointed out what is well known that the death-rate in Liverpool, and I believe it is true also of Manchester, and some other large towns, is much higher than that of London. How far is that owing to the rainfall which is very much larger on the West Coast than on the East? I think, probably, you will all have observed of two of the towns which stand highest in the list Mr. Dines has quoted they are towns on the East Coast where the rainfall is less, and not upon the West Coast where the fall is heavier. It is a curious fact, and one that has some bearing upon the question, that all convictions for drunkenness in England, follow almost exactly the line of the rainfall. That is to say if you draw a line diagonally across England, you can show that the rainfall is greater above that line than below it, and you can find also that the convictions for drunkenness are greater in the district above that line than in the district below it. You may follow that and find a great coincidence in the figures. The reason is plain, for when a man cannot take a walk in the streets because it is raining, he has nowhere else to go but to the public house, and the public house is not supposed to be always conducive to good health. So, perhaps, in that way also a rainy climate has a great deal to do with the death-rate. I will move that a very hearty vote of thanks be tendered to Mr. Dines for his valuable address.

The Hon. **Rollo Russell** (Haslemere): I have much pleasure in seconding the vote of thanks to Mr. Dines, which has been moved by Earl Percy, for his very interesting address. All who know anything of the work of Mr. Dines have reason for confidence in his use of statistics, and in relation to this matter, I was glad to hear him speak in defence of figures, which it is a fashion to attack very unfairly; in fact, there is a saying that nothing is so untrustworthy as figures, except facts. Mr. Dines' figures, however, may be relied upon.

The motion was then carried with acclamation.

Mr. DINES (Leatherhead), said: I thank you very much for the kind way in which you have received my address. I may say that when I was first asked to hold the post of President of this Section, I thought there must be some mistake, for I did not feel in any way qualified to do so, hence I must thank you the more. With regard to Earl Percy's remark about the rainfall I have not considered the question, excepting that I did ascertain for the English quarterly death-rates, that a wet or dry summer did not make any difference. A wet hot summer, or a dry hot summer have high rates, and in England a cold summer is mostly a wet one, thus taking England as a whole most of the wet summers during the last thirty-five years have been healthy. There is more rain, and I believe a higher death-rate, in the West and South-West than in the East and South-East of England, but it does not follow that the quantities are connected.

CONFERENCE OF PORT SANITARY AUTHORITIES.

ADDRESS

By A. HOLT-BARBER, Chairman Port of London Sanitary Authority,

PRESIDENT OF THE CONFERENCE.

I feel that I must, in the first place, acknowledge with grateful thanks the honour that has been conferred upon me, as Chairman of the Port of London Sanitary Committee, by my nomination as President of this important Conference of Port Sanitary Authorities; and I feel sure that good results will follow from this meeting of representatives from the various ports of the Kingdom. The first Conference of Port Sanitary Authorities was held in the Council Chamber of the Corporation of the City of London in 1893, and that meeting had a most beneficial effect in strengthening the hands of the medical officers of the different ports at a critical period, when the importation of cholera into this country was seriously threatened. It is therefore with very great pleasure that I now cordially welcome the attendance here to-day at this Conference of all representatives of different Port Sanitary Authorities, feeling sure that increased efficiency in the work to be carried out will result.

It must be universally acknowledged that a free and uninterrupted intercourse with foreign nations is the very life blood of this commercial country, with its teeming millions of working population, depending upon daily toil for daily food, and to whom any cessation of either imports of raw material or of exports of our manufactured products must mean a cessation of employment, and consequently a cessation of the daily wage necessary to their existence.

But on the other hand—although this free and uninterrupted intercourse with foreign nations is so essential to our well-being, and even to our very existence—there is a danger of another kind which confronts us, arising out of this very commerce, namely, the introduction of dangerous diseases from countries which may be, and are, peculiarly liable to produce them.

In order therefore, to carry on our foreign trade, without danger on the one hand, and without delay on the other, the various Port Sanitary Authorities have been called into existence. It has been well said that "The gods help those that help themselves," and this is essentially a matter in which we are called upon to help ourselves by adopting the best known means that modern science has placed at our disposal. The work as now carried on by the Port Sanitary Authorities may be divided into two separate functions: first the very important duty of *medical* examination of all vessels arriving from over seas, and in cases of arrival from ports scheduled as being infected a medical examination of every person on board; then secondly the *sanitary* inspection of all vessels whether coastwise or otherwise, for the purpose of examining the accommodatoni provided for those living on board, whether crew or passengers and where this accommodation is found to be defective, pointing out the defects, and serving notices for alteration and correction.

This latter part of the duty now imposed upon the Port Sanitary Authorities is a very important, and at the same time a very difficult one to carry out, on account of the constantly moving character of the subjects of inspection and of the ever-varying conditions of life on board ship. When one considers the large number of vessels frequenting a port like London, the short stay that is now generally made, and the extent of the district to be worked, it will be seen that it is no inconsiderable task, to keep a watchful eye over such matters as ventilation, crew accommodation, water-supply, and the many details connected with life on board ship, where a large number of persons have to be accommodated in a small space. In the duty of medical inspection, of a ship arriving from a foreign port, scheduled as being an infected port, the medical officer boards at the point of arrival, and examines every person on board. Any case of infectious disease is at once removed to the proper hospital, the ship and contents as far as possible are chemically fumigated, and then allowed to proceed to her place of discharge.

This you will at once see imposes a large amount of responsibility on the medical officer, for in his hands is placed a very large discretionary power, and which he is constantly called upon to exercise. It has however been proved by experience that the barrier thus raised by medical inspection is sufficient, and with the further growth of medical knowledge, we may fairly assume that the protection thus afforded will be good enough for the future.

Of course, as we place such implicit reliance on our medical officers, it is essential that Port Sanitary Authorities should exercise great care in appointing efficient men to these posts, and that the remuneration and the staff should be sufficient for all possible requirements.

At present the burden of this outlay has to be borne by each individual port, and the ports very naturally object to a continuance of this arrangement, for they alone are saddled with an expense, incurred not for their good only, but equally for the good of the whole country.

It is a well known principle of maritime law, that what is done for the benefit of all should be paid for by all; for instance, when a master cuts away masts or sails to save the ship and cargo, then ship and cargo equally contribute their due proportions to make good the loss incurred.

It will be easily seen how unequal and unjust the burden is that has to be borne by the ports when we consider the position of small places like Harwich, where large numbers of people from the Continent of Europe are landed daily, and pass on at once by railway to various parts of the country. This through passenger traffic confers no benefit whatever on the port, but the port has to bear the whole burden of medical examination, which if efficiently performed is a considerable expense to a small place, and if inefficiently performed may become a source of great danger to the country at large.

I have only instanced Harwich, but there are several other equally weak spots that might be mentioned. It has been contended that the ports reap a *peculiar* benefit from their natural position as ports, and therefore must bear their *peculiar* burdens, but whatever ground there may have been for this argument in the past, it almost ceases to be an argument now, for by the extension of the Limited Liability Acts to ship owning it may be said that ship owners or owners of shares in ships are scattered all over the inland parts equally with the ports. There is no doubt that the wisdom of Parliament could readily find a way not only to furnish the funds, but also to devise proper means of restraining unnecessary expenditure, whilst not unduly interfering with a proper control by the local Port Sanitary Authority.

In London this necessary Port Sanitary work is very efficiently carried out by a committee of the Corporation of the City of London, which body most liberally provides the funds, not only for medical inspections at Sheerness and Gravesend, but also for a number of inspectors both afloat and on shore who are constantly employed in the sanitary inspection of ships, steamers, and barges frequenting the port. These inspectors also keep a watchful eye on all imported food-stuffs, and not a month passes without some quantity either large or small being condemned as unfit for use by man, this showing the necessity for ceaseless vigilance in order to prevent unsound food being introduced for sale amongst the poorer classes. It has been a subject of congratulation to the Corporation of the City of London that H.M. late Government highly commended the way in which our port sanitary duties are being carried out by stating that London is far in advance of any other port in the efficiency of its arrangements, but this commendation seems only to have stirred our highly valued medical officer, Dr. Collingridge, to further exertions, for he has lately succeeded in inducing my committee to build an additional steam launch which will be almost exclusively devoted to the work of sanitary inspection. I may, however, mention that my committee in London think that more work in this direction should be done in the out-ports.

In making these few remarks I have merely glanced at the general outline of the duties of Port Sanitary Authorities, and the great importance to the country at large of their being honestly and efficiently carried out, and I wish to emphasise once again that it is not merely a local duty we are doing but a most important duty to the whole nation, the cost of which should be borne by the national exchequer.

CONFERENCE OF MEDICAL OFFICERS OF HEALTH.

ADDRESS

By ALFRED HILL, M.D., F.R.S.E., F.I.C., Medical Officer of Health, Birmingham.

PRESIDENT OF THE CONFERENCE.

(FELLOW.)

SOME REMARKS ON DIPHTHERIA.

THE experience of Birmingham in respect of diphtheria during the last twenty-three years has been so peculiar and striking that I am prompted to embrace this opportunity to make a few remarks upon it, more especially as the disease has recently undergone important and quite unexpected developments, not only locally, but in the country generally. I am not presumptuous enough either to attempt the elucidation of its Ætiology or to suppose I can do much to advance the means of its prevention, but I have thought it would prove interesting, and possibly to some extent useful, to state some of the facts in connection with the Birmingham outbreak, and make some comparison between our city and other large centres as well as the country generally.

My official experience and statistics of diphtheria in Birmingham date from the year 1873, when the death-rate of this disease was 310 per million persons living. The following year it fell considerably, and it continued to do so more or less regularly until the year 1894, or a period of twenty-two years, when it had diminished to 100 per million, or, otherwise stated, the death-rate fell from 200 per million in the five years, 1873—77, to 110 per million in the five years, 1890—94. In the previous year, 1893, it was still lower, viz., 90 per million. But with the advent of 1895 came a complete change, for in that year the death-rate rose suddenly to 330 per million, a higher figure than had ever before been recorded, and just three times as high as the average for the five preceding years. Nor is this all, for in the first six months of the present year, 1896, the deaths showed a further great increase, and seem certain to produce a rate for the whole year of over 500 per million at least. A serious feature revealed by the notification statistics is that there has been a progressive increase in the number of cases ever since the beginning of 1895, irrespective of season which generally so much influences prevalence; the quarterly figures for the six quarters last past being—121, 124, 159, 236, 259, and 274 successively. Moreover, this increase quite differs from the ordinary seasonal prevalence of the disease. From 1890 to 1894 the diphtheria cases were fewest in the first quarter of the year, and rose to a maximum either in the third or fourth quarter, falling again in the first quarter of the succeeding year. But the first quarter of 1896 instead of showing a reduction on the latter half of 1895, such as that observed in all previous years, has on the contrary shewn a great increase. And another curious feature is the great variability of the case mortality which was 27 per cent. in 1890 and 25 in 1891, fell to 15, 13, and 16 in 1892—3—4 and then rose again to 25 in 1895, so that to increase of prevalence greater virulence of type is now added.

In Birmingham, therefore, we are face to face with the inexplicable circumstance that a disease like diphtheria, which is supposed to have a close relation to sanitary conditions, has now, after falling steadily for over twenty years, a period marked by enormous advances in the sanitary position of the town, suddenly assumed a degree of prevalence such as had never been known before.

I have endeavoured to discover what has been the statistical history of diphtheria in the country generally, and in certain centres of population. But in England and Wales, prior to 1855, the deaths from diphtheria were classed by the Registrar General with those from scarlet fever, and up till 1858 it is a question if they were fully separated. From 1858 to 1860 the death-rate from diphtheria was 372 per million. For the next four quinquennia it fell to 248, 127, 121, and 122. Then it rose to 156, and again to 170, while in the four years 1890-94 it is stated as 251 per million, showing apparently a very great increase. I say "apparently" for this reason. It is the custom of the Registrar General to debit diphtheria with those deaths certified from croup which are distinguished by the adjectival prefix "membranous," deaths returned simply as croup being placed under the head of croup amongst the respiratory diseases. The term membranous croup has become much more common in recent years than it had been before, and consequently many deaths which would formerly have been classed as croup are now taken from that category and placed under diphtheria. This, I think, is clearly shown by the fact that while the diphtheria death-rate rose from 170 per million in the five years 1886-90 to 251 in the next four years, the death-rate from croup fell from 126 to 66. It seems evident, therefore, that a large part, but certainly not the whole, of the apparent rise in the diphtheria death-rate is due to the transference to that heading of many deaths which would formerly have been returned as due to croup. This transference, however, does not account for the whole of the alteration, for while diphtheria has risen by 81 per million, croup has fallen by 60 only, so that the difference between these two figures probably represents the actual increase in the diphtheria death rate. After making allowance for all this, however, it may be safely said that in the country, as a whole, diphtheria has for the last twenty years been slowly but steadily increasing. Turning to London and the other large towns, I find that in them too the mortality has increased, and at a much greater rate than in the whole country; so much so that while the prevalence of diphtheria was formerly greater in the country than in the towns, it is now quite the reverse, the urban death-rate being much higher than the rural.

From the year 1873 till the end of 1894, therefore, the history of diphtheria in Birmingham was singularly unlike that observed in the country at large, for in the latter a rather slow but very steady increase took place, while in the former a marked decrease was manifest. But in 1895 all this was changed; diphtheria in Birmingham began to increase by leaps and bounds, and like others, I am quite at a loss to account for this sudden increase, which still progresses and continues to become more marked, quarter by quarter.

At such a time Sanitary Authorities and Medical Officers of Health are intensely desirous of discovering the cause and all the means of dissemination of the disease, the mortality from which is so considerable. It is particularly embarrassing to the Medical Officer of Health to be expected by the Sanitary Authorities and others to give unhesitatingly an explanation of the causes and means of prevention of the disease, which they sometimes ask for, and very trying to come under condemnation because such explanation cannot be given: for diphtheria is, and one acutely feels that it is, one of those *opprobria medicinæ* of which there are still too many, and towards the diminution of which hygienic effort is constantly directed. It behoves the sanitarian, therefore, to do everything in his power by constant and careful observations, records and experiments, to add something to the common stock of knowledge at present possessed on the subject.

Diphtheria is looked upon by most people as a comparatively new disease. I think this is a common impression even in some medical minds, and it is probably the result of the comparatively new name given to it by Bretonneau seventy years ago, when in his work on the subject he described an epidemic of it which had visited Tours in the year 1818. Observing the adventitious "skin" or membrane in the throat to be a characteristic accompaniment of the complaint he named it "Diphthérie." I remember that about twenty years later, somewhere in the forties, much stir was created by an importation into England of some very severe and fatal cases of a disease then called "Boulogne sore-throat," by children who had visited that town, and it was attributed to the condition of the *port* or harbour, which at that time received the sewage of the town, the solid portions of which lay exposed, as I have seen it, a filthy and most offensive mass of mud and excrement, whenever the tide was out. This disease was the newly named diphtheria. Some years later, in 1857, the most severe outbreak known in this country and Europe generally, occurred, since which time the disease has never left us, while it shows a marked tendency to increase and has become endemic in our large centres of population. It would thus appear that epidemic visitations of this disease occur at very irregular intervals, which, however, are frequently exceedingly long, as much as thirty years, in which respect it differs widely from the other infectious diseases. Before the disease was christened diphtheria, however, it had existed under other names from the very earliest times, and the symptoms described by ancient and mediæval authors who called it "angina maligna" agree with those which characterize it to-day. So that like other zymotics it continues to "breed true."

A feature which invests the disease with additional interest, is that amongst the principal zymotics it exhibits a continually increasing relative numerical importance. If for instance we compare its death-rate with those of small-pox, measles, scarlet fever, whooping cough and typhoid fever in England and Wales, we find that in the decade 1871-80 it was only half that of smallpox, in the next decade 1881-90 it was nearly four times as high as that of smallpox, while in the four years 1891–94 it was eleven times as high. The ratio of the diphtheria death-rate to measles in the first-named period was 1 to 3·1, in the second period it was rather higher 1 to 2·7, while in the third period referred to it was as much as 1 to 1·7. Compared in the same way with scarlet fever the ratios are for the three periods respectively 1 to 6, 1 to 2, and 1 to 0·8; with whooping cough they are as 1 to 4·3, 1 to 2·8, and 1 to 1·7, while with typhoid fever they are as 1 to 2·7, 1 to 1·2, and 1 to 0·7. These arithmetical ratios serve to show how greatly the disease has during the last twenty-five years gained in prevalence, and how much therefore it appeals to the attention of all concerned in public health work. It cannot be said to have appealed in vain, for its investigation has been industriously carried on in all parts of the scientific world, and much light has already been thrown upon it by the labours of bacteriologists and others. There is good ground to hope that such labours will be crowned with splendid success, but in the meantime every common condition in the entourage of the patient calculated to favour the disease should receive the most careful attention. Among these conditions have been included dampness of soil and incidentally of houses. Certainly the one condition I have found most frequent in connection with diphtheria cases is that of dampness, and however it may act whether by lowering vitality and exerting a predisposing influence, or by favouring the life of the bacillus already existing in the soil in which it is believed it may lie dormant for an indefinite time, the indication clearly is to prevent or remove the dampness. In connection with this subject I may remark that the mere digging out and fresh exposure of soil has been frequently observed to precede attacks of diphtheria, which lends probability to the hypothesis of bacilli existing in the soil. That the bacillus diphtheriæ possesses great tenacity of life for long periods has been experimentally proved by Löffler who found that when dried it was capable of cultivation after a lapse of over three months.

The subject of locality is one of great practical interest. The change of principal incidence from the country to the towns, or rather from sparsely inhabitated districts to those whose populations are more dense, is as remarkable as it is true. It is unnecessary to dwell at length on this point, striking as it is, inasmuch as it admits of no dispute, and is very clearly set forth in Dr. Longstaff's Report to the Medical Officer of the Local Government Board in 1887. This increase of the disease in towns has in recent years become more marked and is not the result of mere transference, or rather transposition, for it is not accompanied by a diminution of it in the country generally, as a fact the malady increases in both, but its increase in densely populated places, large towns for instance, is relatively greater than elsewhere. Thus if we compare England and Wales with London we find that in the three decennia, 1861-70, 1871-80 and 1881-90, the diphtheria death-rates per million persons living were respectively 187 in England and Wales against 179 in London, 121 against 122, and 163 against 259. In the first period the London mortality rate was a little below that of England and Wales, in the second it was virtually equal with it, while in the last it was 50 per cent. higher, and again while the death-rate for England and Wales in the 20 years 1874-93 just about doubled itself, that of London increased more than six times. More recent returns also enable the comparison to be extended to thirty-three other large towns during the twelve years 1882-93. In this period the average diphtheria mortality for England and Wales was 185 per million, for the thirty-three large towns 225 per million, and for London 327 per million, while the percentage of increase was respectively 109, 169 and 222. The remarkable fact in connection with Birmingham is that all this time while the death-rate from diphtheria in the country generally was going up, that of Birmingham was tending downwards, as I have already pointed out, and we fondly indulged the hope that we should enjoy in the future not only as much, but still greater, exemption from it. I have shown how this hope has been disappointed and that Birmingham has at length followed suit to other large towns.

In connection with the influence of locality that of elevation may be conveniently considered as far as Birmingham is concerned. I have heard many statements on this subject, some persons maintaining that the lowest parts, others that the highest parts of the town suffer most, the reason assigned for the latter view being that sewer gas travels from the lower to the higher levels and escapes at the upper end of the sewerage system there exerting its injurious effects, among others spreading diphtheria. The city varies in height from 675 to 281 feet above sea level, it is divided into eighteen wards, the most elevated one having a mean height of 530 feet, the lowest a mean height of 385 feet above sea level. The ward having the greatest mean height had virtually the same case-rate as the least elevated ward but two, while the ward having the highest case-rate occupied about the middle position. This want of the relationship in question is not peculiar to 1895, but extends, I find, to the two preceding years. It is thus evident that there is no definite relationship between elevation and diphtheria prevalence.

I have given some attention to the subject of house accommodation in Birmingham in reference to diphtheria. There is a common idea that diphtheria is more prevalent in better class houses than in inferior ones. In order to test this notion I tabulated the houses which were invaded by the disease last year, and found that 195 out of 517 consisted of five rooms and upwards. So far as I can learn from the census returns there were in 1891 about 41,000 houses in Birmingham containing five rooms or more, out of a total of 95,000; thus diphtheria occurred at one out of 170 of the smaller houses, while only one out of 210 of the larger houses was invaded, the larger houses thus suffering considerably less than the smaller ones.

Closet accommodation cannot be ignored as a very probable source of danger, and I therefore made inquiries last year into this matter. Assuming, as I had reason to do, that about as many houses were provided with pan privies as with water closets, there were found to be rather more cases amongst houses furnished with pan closets than amongst those having water closets. It was also found that a second case occurred at one out of eleven of the houses with pan closets and only one out of twenty-nine of the houses using water closets. These facts appear to show that pan closets favour the introduction of the diphtheria virus a little, and when it is introduced facilitate its spread in a marked degree.

School attendance with its aggregation of large numbers of children in the closest association in an atmosphere by no means too pure, has been naturally regarded as a very probable means of spreading the disease, which it no doubt is in some cases. I have no intention of entering upon a discussion of this question which, simple as it appears, is still debatable. I only wish to lay before you the results of my observations in Birmingham during last year. It is by the collection of similar experiences from a wide field, and over a long period, that such subjects can be removed from the region of doubt to that of certainty. On this point I made the following remarks in my last annual report. " I have endeavoured to discover how far the bringing together of a large number of children in schools affects the spread of diphtheria. Of the 517 houses invaded there were 163 in which no children attended school, and 168 others in which the patient did not attend school, though other children from the house did so. I do not see how any school influence can be made out in these cases. This leaves 186 patients, who themselves were in attendance at school, out of a total of 517. But these 186 cases occurred in children attending no less than 74 schools, giving on an average a little more than two cases per school per annum; and in only forty-one instances had there been a previous case at school within a fortnight. These forty-one cases out of 517 may possibly have contracted the disease at school. I do not see the least probability that any of the others did so. I think it must be admitted then that schools have very little to do with the spread of diphtheria so long as proper precautions are taken to keep away all children from infected houses as is done in Birmingham.

"But while this is so, as a general rule, there can be no doubt that occasionally a school does become a centre of infection. This was well illustrated last year at Harborne. There had been very little diphtheria there until October 9th, when the case of a child attending the Board School was notified to me. At intervals, varying from one to thirteen days, as many as ten other cases occurred at the school in less than six weeks, and the patients all being very young children they would of course be closely associated at school. Moreover, between October 9th and November 29th, there were altogether eighteen cases of diphtheria and croup at Harborne. Of these eighteen patients thirteen attended the school, and four out of the remaining five lived with children who went there; so that only one case occurred in the district which did not connect itself either directly or indirectly with the school. From enquiries made I learned that about nine years before there had been an outbreak of diphtheria at the same school, and the drainage had been re-arranged. The old drain was disconnected from the sewer, but was not taken out at that time. About the 16th of October this old drain was taken up when it was found to be full of dry solid matter. This, however, was a week after the first case occurred at the school, so that it does not seem to have originated the outbreak, though perhaps it had some influence on the spread of infection among the scholars. At my request the school buildings were fumigated. During the next month only two cases occurred at Harborne, and neither of these was in any way connected with the school."

Among other matters calling for further observation and study in relation to the disease is the liability of animals, particularly of cows and cats, to attacks of the disease, and their susceptibility to inoculation with cultures of the diphtheria bacillus. In these inoculations, except in the case of the cow, the baccilli are found only at the point of inoculation, and the constitutional effects are therefore probably due to the action of a chemical poison produced by the bacillus and carried into the circulation. This view is confirmed by the experiments of Roux and Yersin, who proved that a pure culture from which the bacilli had been removed by filtration is still pathogenic and on inoculation by it, it actually produced the general symptoms of the disease.

In the case of cats, the danger of their communicating the disease to human beings consists only in contact or close association with them. The conveyance of the infection by cats which Klein considers susceptible to true diphtheria, and capable of communicating it to each other and human beings, is worthy of careful consideration. It is consolatory to know that he considers it proved that fowls do not suffer from any ailment either identical or intimately connected with diphtheria.

With cows there is greater danger, because, according to Klein the cow suffers from a disease resembling diphtheria, and the milk contains the bacillus, thus offering a remarkable exception to man and the other animals in which the bacillus is confined to the local lesion and neighbouring glands. The bacillus moreover grows readily in milk, and milk is regarded after many careful investigations as a real source of danger. These facts present very vividly the danger contingent on the use of milk, because it may be infected not only after, but also before it is drawn from the udder.

The natural issue of these considerations is the application of all such knowledge as we possess to the prevention and mitigation of the disease. The means to be employed embrace notification, isolation, rigid exclusion of diphtheria cases from scarlet fever wards, disinfection of clothing, bedding, furniture, &c., strictly regulated school attendance, supervision of milk supplies and the boiling of all milk, removal of dampness, darkness and other insanitary conditions from sites and dwellings, careful observation and isolation of cases of sore throat however mild, the destruction, or at least effective disinfection, of sputa, and finally what up to the present time has not received the attention it demands, the resort to the bacteriological examination of all cases of sore throat however trivial they may appear, and the employment of bacterial cultivation during convalescence from diphtheria until the microbe can no longer be detected. This proceeding is necessary because of the uncertainty as to the time when the danger of infection is at an end. Such bacteriological examinations would of course occupy much time and entail much expense, and they could only be performed in laboratories established for the purpose, where also could be practised injections of serum anti-toxin from which it would seem that much is to be expected not only from a curative, but also from a preventive point of view.

I am impressed with the difficulty, importance, and extent of the subject I have touched upon, and must express a regret that I have only been able to deal with it in so incomplete and imperfect a manner. My remarks will at least have partly secured my object by enabling me to contribute a little experience of my own, and to ask you to follow my example, so helping to extend, however little, our knowledge of one of the most terrible and pathologically obscure diseases of the present day.

CONFERENCE OF MUNICIPAL AND COUNTY ENGINEERS.

ADDRESS

By FRANCIS J. C. MAY, M.Inst.C.E., Borough Engineer and Surveyor, Brighton.

PRESIDENT OF THE CONFERENCE.

In opening the proceedings of this Conference of Municipal Engineers held under the auspices of the Sanitary Institute, I wish it to be clearly understood that we are not present to represent the corporate body of Municipal and County Engineers, but as individual members of a profession, and engaged in the particular branch of that profession which deals chiefly with matters relating to the public health. We are here as municipal engineers, each in his own sphere of labour, interested in securing the highest degree of sanitation in the town forming that sphere of labour.

Parliament has invested the Local Goverment Board, among its other duties, with the administration of the public health throughout the land; and it has hitherto performed those duties wonderfully well; but the subject is one that grows in magnitude, and of which the details of the duties increase every year, so that I think the public health department should now have a separate existence from the Local Government Board, under a recognised chief, who, as Minister of Public Health, should have a seat in the Cabinet.

We serve those local authorities, who, under the control and direction of the Local Government Board, are entrusted by parliament with the care and guardianship of the public health throughout the length and breadth of the kingdom. We recognize the fact, that the health of the people is a subject which concerns not only the government, and the local authorities, nor one set of persons or one profession; but that it is a matter in which the desired results can only be acquired by the joint action and co-operation of many parties and professions.

The care and supervision of the government and local authorities—the efforts of those in high position in the land, and with leisure at their command, who desire to help from a humanitarian point of view—of the clergy, and others whose calling leads them into the vilest slums and alleys of our towns, or into the by-ways of our country parishes, where houses are in an insanitary condition, where water is scarce and of low quality, and where a low order of the necessities of life generally prevails—of the medical profession individually, who with their scientific knowledge, coupled with their generous and often gratuitous labours among the indigent poor, have opportunities of learning the condition of their lives and surroundings—but more especially of that branch of the medical profession with whom we are closely allied in municipal life,—the medical officers of health—of the engineering profession to which we have the honour to belong—of the public sanitary officers of every degree. The hearty co-operation of these various professions, or sections of society is needed in order to accomplish a higher standard of public health. Each and all of these various sections of society are represented at the present Congress. We willingly join them to show our sympathy with, and desire to help, so far as in us lies, that good work which aims at the reduction of sickness and distress, . the prolongation of life, and the rendering of that life easier and happier, by ascertaining and adopting the best known means to improve the morals, the health, the dwellings, and the surroundings generally, of the whole community. Much has been done during the last fifty years to improve the general conditions of the health of our land. The Sanitary Institute, the British Institute of Public Health, and other kindred societies, have done much to bring about this improvement, but much more remains to be done. The general public need much more further awakening and education in this subject.

We require, from honest conviction of the necessities of the case, the hearty co-operation of individual owners and occupiers of property, and even of every individual of society. How much faster would be the progress of sanitation, if it were only taken up seriously by individuals, each in their own home or locality. I believe that meetings, such as the Congress that is being held here at the present time, and all such others, are the best means of collecting and spreading further knowledge for improving all the conditions of health and life. I therefore cheerfully accepted the invitation to preside over a conference of municipal engineers, in connection with it; and I assume that such were the motives that led you to favour us by your attendance here to-day.

We do not claim that all the desired results in sanitary matters are to be attained by the efforts of the engineering profession, neither can we admit that the medical profession, or any other section of the community alone, can secure them. Medical men must agree, and be content to work side by side with engineers, and all other professions and sections of the community having the common weal in view. All should join hand in hand, and work shoulder to shoulder, without envy or jealousy, in such a good cause. The only rivalry permitted or acknowledged in this matter should be the rivalry of good works and words, each candidly acknowledging the good work done by the other, and thereby cheering and encouraging each other in still further good works.

Having laid down these general views of the subject, I will now proceed to see in what manner we municipal and county engineers can help forward this noble work.

The local authorities, urban, rural and county, whom we serve, are, as I have already said, the responsible bodies on whom devolves the duty of guarding the public health. We often have to advise our authorities on technical matters relating to the public health, and afterwards have to carry out their instructions. How important it is, therefore, that we should thoroughly understand, even to the most minute detail, everything that pertains to sanitary engineering in relation to the public health; and it is, in my opinion, equally necessary that the municipal engineer should have very strong and earnest sympathies with the object, to ensure his whole heart being engaged in his work, so that he may make every effort to be in a position to know, to understand, and to recommend the adoption of the latest revelations of science, or research, for the public weal.

It is impossible, in such a short address as this must necessarily be, to touch upon all the subjects which are embraced within the meaning of the term "Sanitary Engineering," as implied under the requirements of the Public Health Acts, but I will briefly refer to some which I consider the most important. These are;—

1. Water Supply.
2. Healthy Dwellings, embracing inspection of new houses during construction; the removal and disposal of house refuse; the removal of nuisances.
3. Sewerage and Drainage, embracing inspection of the construction, and subsequent testing of sewers and house drains, and of the various connections therewith.

4. Sewage Disposal Works.
5. Ventilation of Sewers and House Drains.
6. The Construction of good Roads and Impervious Pavements, thorough Scavenging, &c.

1. WATER SUPPLY.

I do not propose to enlarge very much upon this subject. We all recognise it as a very important one, but as a rule the supply and distribution of water is outside the purview of the municipal engineer and surveyor, *per se*, and is controlled by the waterworks engineer, the head of a separate department, either under municipal or private government.

One of the most imperative duties of a local authority is to secure and provide an abundant supply of pure water. It is an absolute necessity of health and life, and one as to which economy in its use should be religiously observed. Waste of this essential of life in the household is a sin, and one the waterworks engineer takes steps to check as much as possible. How much greater is the transgression in factories, and places where the demand is greater, and where the means of supervision are correspondingly less. We all know how much the people need to be educated in the virtue of economy in this respect.

I feel, therefore, that the distinct duty devolves upon the municipal engineer to regard the water supply as a commodity of the highest value ; to do all he can to prevent waste in every section of his department; and to restrict its use to that of absolute necessity only. In all building operations, for use in urinals, flushing sewers, street watering, and all such like purposes, the strictest economy should prevail. In many places sea or river water might be used for some purposes ; and, I think, too, that our attention might profitably be turned towards the collection and storage of rain and flood waters for many purposes. By following out these suggestions we shall all be working in harmony with the waterworks engineer for the common good ; and we should do so just as much as if we were ourselves personally engaged in the question of supply and distribution of this most essential element of health and life.

2. HEALTHY DWELLINGS.

a. Inspection of Houses during Construction. I am of opinion that in most cases the building bye-laws are sufficiently stringent for the construction of sanitary houses if carried out strictly ;

but I think the general experience is, that local authorities do not give the local surveyor sufficient assistance to ensure them being carried into effect in their entirety. I think this is a matter which needs to be brought more prominently under the notice of local authorities; and further measures should be adopted to secure efficient supervision at all times.

b. The Removal and Disposal of House Refuse. This is a most essential element in relation to our efforts to secure healthy dwellings, especially among the poorest part of our population. I think it is a great pity that the law does not compel the construction of a back passage for all small property, so as to avoid the necessity for any drain to pass under a house; and to afford facilities for the removal of ashes, and all other kinds of refuse, without carrying it all through the dwelling. It is done, I know, in many of the large towns of the midland and northern counties with good effect. It is not general in the towns in which I have had to work, and I therefore know the great disadvantage of the omission, and the great need for this to be made a compulsory measure. In cases where there is a weekly collection it often happens that the dustmen call when the occupiers are from home, at work, or after the house has been cleaned up, or on a washing and ironing day; cases in which it is either impossible or undesirable from the housewife's point of view, for the ashes to be removed; and so, notwithstanding all the good arrangements made by the local authorities, the ashes are frequently allowed to accumulate for several weeks before removal. This would not occur if the back passage system were adopted. From my experience I have almost come to the conclusion that a daily removal of house refuse in the denser parts of the town is almost a necessity; and if the occupiers were compelled to place their receptables on the pavement before a certain hour in the morning, I believe it would be possible to collect it as cheaply as it is done now weekly by the dustman going through the house to bring it out. I should most readily join in any movement set on foot to bring about the general adoption of the back passage system; it being in my opinion most decidedly the best from a sanitary point of view.

On the subject of the "disposal" of the refuse, I think there can only be one opinion, viz., that all such useless and vile products should be consumed by fire and rendered innocuous. It is, however, a somewhat costly process, and it is useless to think of making a substantial profit out of the residue, although sometimes it is used for making up roads and footpaths, concrete, paving slabs, &c. The amount of the residue is so great that only a small proportion can be utilized in this manner. All hope of realizing profit from the working of a destructor will lead only to disappointment. The question of "Disposal of House Refuse" must be at once regarded as a necessary expenditure, entailing direct loss to the ratepayers financially, but one which is amply repaid indirectly by the reduction of sickness, or distress, and of the death rate, due to the improved conditions of the atmosphere of the dwelling and its surroundings. The ingenuity of all municipal engineers should be directed towards the adoption of all such means as local circumstances will admit to reduce the financial loss to a minimum sum.

The attention of engineers is therefore now being well employed in devising schemes for storing and utilizing the heat produced by the act of combustion, so as, if possible, in this way to reduce the cost of disposal of refuse. Further progress in this direction is in my opinion much needed, and as time goes on further experience will develope new ideas and means. I commend this point to the careful consideration of all those who are contemplating the use of a refuse destructor.

c. The Removal of Nuisances. I intend to pass this by with a very few remarks, as I consider it is one that more properly belongs to the health department, than to the surveyor's department. The medical officers of health, and their staff of sanitary inspectors, are carrying on the crusade against nuisances in most cases in a splendid manner.

In the town with which I am associated, it is most essentially so, and I feel it my duty whenever an opportunity permits the remarks, to bear my testimony to the fact, that, in my town (Brighton) there is perfect unanimity of feeling between the officers of the health, and the engineer and surveyor's departments, so that we are able to work side by side, assisting and encouraging each other in the most friendly manner. This is as it should be, and I hope it is general, or will become so, throughout the land.

3. SEWERAGE AND DRAINAGE.

a. The Construction of Sewers and Drains, Inspection and Testing. This is a matter which may truly be said to be one that belongs in a peculiar manner solely to the municipal engineer. It is most essential that all our work in relation thereto, should be of the very best and truest character. Good workmanship, and absolute truth in the lines and levels, the best of materials of all kinds, and thoroughly watertight sewers and drains, should always be insisted upon. All sewers and house drains should be tested in the severest manner, by the water test.

Whether the subsoil water should first be drained off—the kind of joint to be used to secure the best results under the most trying circumstances—whether the sewer or drain must be embedded wholly or partially in concrete, and all such other matters of detail must be left to the intelligence of the engineer responsible for the work. I think that most failures in any of these respects, whether in sewers or house drains, are due more to a lack of proper supervision, than to any other cause; and I would strongly urge upon all engineers engaged in this work, to insist upon having a proper staff of assistants of the various grades to ensure a faithful adherence to the specifications and plans, which are usually prepared with consummate care, only to be rendered inoperative for want of efficient supervision. The members of Local Authorities are usually men of business and experience, and will generally recognise the folly of parsimony in such matters, if the engineer will only introduce the question with tact and discretion.

It is in my opinion a subject for extreme regret, that, as the law stands at present, it is a moral impossibility in most cases to insist upon the system of back drainage. Local authorities are almost compelled, in self-defence, to insist upon the separate drainage of each house. This of course, in the majority of cases, entails the necessity for taking the drain through the house. Of course, every one knows it is possible to construct a water-tight drain, and we all endeavour to insure it is so, but we cannot guarantee that it will ever remain so. It may be upset by many accidents, quite unknown to, and unavoidable by the sanitary authority, or its officers. I have met with many such instances, and doubtless most of you have also experienced them, and the evil consequences that have followed. These consequences could not have arisen if the drain had not been allowed to be constructed inside the house. I cannot help thinking that the time has come for all parties interested in the public health, to co-operate so as to bring such pressure to bear upon the government, as shall lead to a speedy alteration of the law in this respect. Every sensible man admits that it is only common sense to keep all drains out of the house, and yet the law of the land alone prevents the practice. It will be better for the public when the law of common sense prevails. Let us all do what we can to bring it about.

4. Sewage Disposal.

This I still consider one of the most difficult problems of the present day, notwithstanding all the experiments and experience gained during the last 25 years. It is one which every engineer, or surveyor of a local authority, has, in some measure or other, to deal with. It is therefore incumbent upon us all to take advantage of every opportunity for educating ourselves on this subject, in all its several bearings and details. It is a subject which permits of no universal method of treatment. It is governed almost entirely by local circumstances, relating to the nature of the soil and subsoil—the position of the locality and its surroundings—the nature of the trade, and the habits of the community, among other circumstances too numerous to mention. Local authorities of towns on the borders of our seas, or rivers, avail themselves largely of the facilities for discharging their sewage into the waters; some in its crude condition, others more or less treated by mechanical, or chemical methods, to remove the solids, and to purify the effluent.

Other authorities of towns or villages not so fortunately situated, are dependent solely upon those methods which have been devised for disposing of both solid and liquid sewage on the land, mostly in connection with the water-carriage system.

The first method I consider a barbarous, although cheap, method of disposal. I am not inclined to find much fault with local authorities for adopting it, as I consider it is the most sensible way of dealing with the sewage, where it can be done without harm to others, under the present unsatisfactory state of the question. I do, however, think it is incumbent upon all engineers concerned with this subject, to endeavour to devise some more satisfactory method of disposal. I am strongly of opinion that our attention should be given, as much as possible, to devise some means whereby all fœcal matter, urine, &c., may be returned to the land in its natural condition, to fertilize it, and to repay with interest that which has been taken from it. This cannot be done so long as we rely almost wholly on the water carriage system. A system which while it affords the readiest means of removal of our filth, also destroys all its great manurial value, and is, in my opinion, a sinful waste of the products of nature. I think that the combined efforts of the scientific chemists and engineers are required, the one to render such matter in the dwelling at once innocuous and inodorous, the other to devise some ready means for its discharge therefrom into suitable receptables, which may be removed daily and conveyed direct to the land, without in any way creating a nuisance. I think that pneumatic or electric power should in future be so easily manipulated, as to enable future engineers to accomplish this purpose.

Seeing what a valuable commodity water is, how difficult and expensive it is to obtain a plentiful supply at the present time, and how the absolutely necessary consumption must largely increase with the rapid growth of our population, the time, in my opinion, is not far distant when the large consumption of pure and clean water now expended on the water-carriage method of removal of excrementitious matter, &c., will be considered a wilful waste; and public opinion will demand from engineers, that some more scientific and rational method shall be devised by them. As one having had experience of both the first and second methods, I am able to say, from my own experience, with reference to the second method, that, in my opinion, there has not yet been devised a wholly satisfactory system for the application of sewage to the land, in such a condition as to obtain the fullest beneficial results from this waste product of animal life. It is not my intention to make distinctions between the several methods that are in vogue, or to advocate one system in preference to another, but I wish only to remark, that, in my opinion, the great cause of failure in each case is the increase of volume and the loss of value, consequent upon the dilution effected by the water-carriage system. I therefore feel convinced that a great revolution of opinion and practice will eventually arise, and that future generations will be astonished at our insane waste of the valuable products of animal life, so necessary for the reproduction of vegetable life; and at our ignorance in using such a valuable necessity of life, as pure water, to enable us easily to effect that waste. I regard this question as one of the most important that should engage the attention of engineers and local authorities entrusted with the health, wealth, and prosperity of the whole community.

It is one well worthy of the best labours and intellect of both chemists and engineers in the interest of public health; and as one which will bring to them its own reward, in increased and increasing opportunities for work and practice.

5. THE VENTILATION OF SEWERS AND DRAINS.

I feel that in this I am launching into troubled waters. Notwithstanding all that has hitherto been said or written upon this vexed question it still remains in an unsettled condition, and I am of opinion that it will long continue so. It is one that depends so much upon varying local circumstances that it is impossible to lay down any hard and fast rule. The information that has been given in reference to this question has been of a very conflicting nature, and I think it is high time that investigations should be undertaken by some competent authority in a businesslike and systematic way, and upon some established basis extended over a large area, and for a long period. It is only in this way that such statistics can be gained as will give reliable results. My own opinion, after many years of experience, is that the freest ventilation possible combined with thorough and regular flushing is the best—that grids in the roadway should only be placed in such positions as will enable them to act as air inlets, and not as outlet ventilators; that ventilation should be carried out mainly by means of shafts, of ample area, attached to high houses or buildings. This is the principle that I have been carying out during the last seven years with great success. I have usually been able to secure sites for ventilators, by arrangements with owners of property, on very reasonable terms. The ventilators being built entirely by my own workmen, on my own plan, designed in such a manner that the shaft appears to be a part of the building to which it is attached, and therefore it does not become an eyesore to the owner or occupier of the building. Care is always taken that it is built in such a manner that it is wholly distinct from the house; so that it is impossible for sewer air in any way to penetrate it, or to escape into, or to be drawn into it.

I have also introduced with much advantage balanced check valves at different places near a ventilating shaft, to prevent the sewer air of the low levels passing to the higher levels, when the velocity of air in the sewer is very great. Whenever I have had complaints of a street grid being offensive, instead of closing it, I have sought a suitable site near for a vertical shaft, and when this has been built the alleged nuisance from the street grid has ceased, and it has been found to act as an air inlet instead. On the house drains it has always been my practice to place an intercepting trap between the house and the sewer. I consider that the ventilation of the sewer should be self-contained, and should not require the house drain to serve as a ventilator for the sewer. I think it is not fair to cast this burden and responsibility on private owners. I also consider the practice very objectionable and dangerous, when, as is generally the case in large towns, the house drain passes under and through the house itself. Immediately behind the intercepting trap in front of the house, the fresh air inlet should be placed, and there should be no obstruction between it and the ventilating shaft at the rear, then I think we may feel that all has been done to secure a regular current of fresh air throughout the house drainage. I think it is better to depend upon natural ventilation, with exhaust cowls where necessary, than upon any mechanical system that has yet been devised. I am convinced, too, that it is not prudent to rest for ever contented, after knowing that the house drainage and ventilation has been satisfactorily constructed. All houses should be periodically inspected by competent officials to detect those accidents by which the initial arrangements are frequently upset, and to ensure that everything is remaining in working order. All amendments, alterations or restorations found to be necessary should be supervised by the engineers' or surveyors' department under whose direction the system was originally designed, approved or constructed.

6. CONSTRUCTION OF GOOD ROADS AND IMPERVIOUS FOOTWAYS, SCAVENGING, &c.

This section of our work is, in my opinion, by no means the least important as a factor in the condition of the public health. Good roads, properly constructed, from which the rainfall is most easily drained, and from which the debris and filth is most readily removed from the surface, help to reduce the moisture so detrimental to health. I do not propose now to enter into any description or comparison of the relative values or merits of the various kinds of materials in use, nor to speak on the subject from economic grounds. I merely wish, at this sanitary meeting, to emphasise the fact that this is a subject to which engineers would do well to devote much more attention than is frequently the case, from a sanitary standpoint alone. The more impervious the roadway is, the better is its sanitary condition, and this quality should be constantly aimed at. There has been a great improvement generally during recent years, and a higher standard is undoubtedly required now than at any previous time, owing largely to the introduction of cycling. The further introduction of auto-cars, &c., will doubtless lead us all to aim at still greater perfection in the surface of all carriage-ways.

The better the condition of the road surface, the more easily and efficiently it is scavenged. The more cleanly the roads are kept, the better it is for the health and temper of the people. The more even the surface, the less is the wear and tear of carriages and horses, bicycles, and motor cars. This question is therefore becoming more than ever one in which all classes of the community are concerned. The higher standard of perfection required leads to a corresponding increase of expenditure, but there is also indirectly a like saving of expense as a set-off against it, in the reduction of the wear and tear of the property of the individuals who use the roads—as nearly everyone now does—by one or other of the before-mentioned means of locomotion. There is every reason, therefore, for engineers to consider and to study this subject in a scientific manner now, as Telford, Macadam, and other eminent engineers did in the early part of the century.

The question of footway pavements I propose to treat also from the same sanitary standpoint only. In reference to them I have only to remark that I consider it to be, in towns especially, most important that they be of such a character, and laid in such a manner as to keep the basements as dry as possible. This is most essential when they are used as living rooms; and it is scarcely less so when otherwise, for the damp air of the basement must, at times, more or less affect the general condition of the air of the whole dwelling. Without expressing any opinion of the merits or demerits of the various kinds of pavements in use, I recommend the adoption of those which are non-absorbent, and which can be laid with the smallest number of joints. There are, of course, many that answer this description, but they vary in cost; the municipal engineer should make his selection having regard to the local conditions of traffic, situation, gradient, character of the neighbourhood, &c., in addition to the initial cost, and that of the probable repairs.

The foregoing subjects are some of those relating to the sanitation of towns and villages, which lie within the compass of the daily duties of the engineer or surveyor. There are of course many others, equally important, of which time will not permit me to speak in this address, such as the construction of artisans' dwellings, municipal common lodging houses, sanatoriums, or isolation hospitals, public abattoirs, mortuaries, cemeteries, and even crematories, &c., &c.

I trust, however, that I have said sufficient to prove the necessity for the municipal or local engineer and surveyor to have his heart and sympathy engaged in the duties of his office, from a humanitarian point of view, as well as to keep his professional knowledge well abreast of the times, seeing how largely he may be able by his personal skill, and intelligence, to assist and forward the great work that the local authorities, The Sanitary Institute, other kindred associations and philanthropic persons desire to promote. Also, that we, and the members of the various other professions engaged in the same work, should agree to work together with harmony and good-will, not trenching upon each other's duties, or positions, whereby one or the other may feel offended, but working shoulder to shoulder in support of each other, for the common weal.

I must now conclude, feeling that I have left much unsaid which might have been enlarged upon if the time had permitted, still hoping that I may have said quite sufficient to prove that the engineer plays a very important part in the work of sanitation, and to encourage others, as well as ourselves, not to be weary in well doing in our several spheres; but to do all that we have to do with our very best efforts, not only for our own personal or professional interests; but from higher motives still, remembering that it is only by the concert of all our individual efforts, that the sanitary condition of our country can be perfected, and those desirable objects—improved health, increased happiness, and longevity of our fellow-beings can be secured.

Finally, I trust that this Congress of the Sanitary Institute will also have the effect of educating the people still further on this important subject, and stimulating them to action, by shewing them how much can be done to promote the health of the whole community by the individual who will take an intelligent interest in his own surroundings.

CONFERENCE OF SANITARY INSPECTORS.

ADDRESS

By GEORGE REID, M.D., D.P.H.

(Medical Officer of Health, Staffordshire County Council.)

PRESIDENT OF THE CONFERENCE.

(FELLOW.)

It is customary for the President on an occasion such as this to address a few remarks to those who are present, before the business proper of the Conference begins, and he generally prefaces his remarks by acknowledging the compliment which has been paid him in inviting him to occupy the chair. As, however, I am here not on your invitation, but at the request of the Council of The Sanitary Institute, I cannot follow this precedent, and feeling, as under the circumstances I am bound to feel, that to this extent I have been forced upon you, I appreciate all the more the importance of doing my best to acquire that which it by no means follows I possess, namely, your confidence. Being in this somewhat anomalous position then, I must claim that indulgence which I know I can look for from fellow-workers, many of whom, probably, I do not meet to-day for the first time, and this, at any rate, I can promise, that I shall not weary you by unduly extending my opening remarks.

Presidential addresses on these occasions too often savour somewhat of after-dinner speeches. We are rather inclined to pat ourselves on the back, to magnify our virtues and multiply our wrongs, until a picture is presented of a body of unrecognised paragons, who, in their self-sacrificing zeal for the cause, go about from morning to night with their lives in their hands, and, in return for a miserable pittance which a good mechanic would decline to work for, submit to be trampled upon by those in authority over them. The cause, I think, is not in need of any such extravagant arguments to justify its claims, do not let us weaken it then by advancing them.

A sanitary inspector is nothing more or less than a common-sense man who is honestly interested in his work; he is prepared to accept any risk incidental to it; his interests are those of the public at large; he should receive a reasonable acknowledgment of his services in the way of salary; and he is entitled to expect that the conscientious discharge of his duties shall in no way imperil his livelihood.

Now we all know very well that there is great need of reform in the existing relationship between sanitary officers and their authorities, and that until this reform becomes an accomplished fact, sanitary progress must be comparatively slow; but like all reform it can only be brought about with the help of public opinion. We also know that the British public are far more likely to be influenced in this direction by good solid arguments, supported by convincing practical facts, than by columns of eloquence descriptive of the great worth and long-suffering patience of the much abused sanitary inspector.

It must also be remembered that the machinery of public health is comparatively new, and that experience alone can indicate in what respect it is at fault. It can only be repaired by legislation, and our legislators have many other faulty machines to put right besides this one. Matters may be hastened, no doubt, by availing ourselves of every opportunity of bringing home to the powers that be the absolute necessity for reform, but it is by judicious argument and plodding perseverance, and not by sensational appeals, that we can hope to attain the end that we all have in view.

I propose in my short address to direct your attention, first to the matters we have to complain of, and secondly, to the means by which, in my opinion, they may be remedied with the least possible delay and the smallest amount of friction.

Our chief grievances may shortly be summed up as follows:

1. The frequent disregard by authorities, in appointing their officers, of evidence of qualification in the shape of experience and training in sanitary work.
2. The insecurity of tenure in such appointments.
3. Inadequate salaries and allowances.

A few years ago I had occasion to enquire into this question rather fully, in preparing a paper for the International Congress of Hygiene and Demography, which met in London in 1891. I then collected much valuable information relating to other countries as well as our own, but I only propose to refer to-day to certain returns I received from the county in which I am more immediately interested, and which, being largely rural as well as urban in character, is fairly representative of England generally.

I do not propose to comment upon the conditions of such appointments in the case of inspectors of large towns, as our grounds of complaint more especially, although not entirely, apply to non-county boroughs and small urban and rural districts.

As regards the salaries paid in the case of towns of under 50,000 and over 30,000 inhabitants, I find the amount, on an average, is about £2 a week—the wages of a skilled artisan.

Among the smaller towns, the salaries paid vary very much, and extra duties of a varying nature, and not necessarily connected with sanitary work, are frequently imposed. For example, in one town with a population approaching 20,000, the inspector receives, for sanitary work, £35 a year, whereas in another town with only 6,000 inhabitants, the salary for inspector's work proper is £80. The contrast is still more marked, however, for in the former case the salary is made up to £95 in return for additional work as a rate-collector, while in the latter, (the town of 6,000 inhabitants), the salary is supplemented to £365, and extra duties as surveyor, engineer of a water works, and inspector of a rural district are also included; he is expected, however, to provide himself with assistants.

In another case the inspector, who is also rate-collector, is paid the munificent joint-salary of £35 a year.

In less than one-half only of the urban districts from which I received returns (thirty-nine in number) was there permanency of tenure in these appointments.

In nine only of the thirty-nine urban districts did the inspector possess any knowledge of his duties previous to his appointment, and in three instances only were any definite conditions as to previous knowledge imposed on candidates. It is but fair to mention, however, that in many of the cases no recent vacancy had occurred; still, in seventeen instances appointments had been made within five years previous to the inquiry, and in six only of these did the persons appointed possess any previous knowledge of their duties.

With regard to the previous occupations of the inspectors holding appointments in the urban districts in question, they were too varied to enumerate, but policemen, rate-collectors, clerks, and farmers formed the bulk of them.

In the schedule of questions in connection with this enquiry I included the following: "Are you of opinion that you can efficiently discharge your duties as inspector, or do you consider that your district is too extensive, or that other duties (if you have any) occupy too much of your time?" From the answers received to this question, it appeared that in no less than twelve instances in the case of towns with over 15,000 inhabitants, the inspectors admitted their inability to perform their duties properly, the reason given in four instances being that the supervision of refuse removal—work which, I suggest, might very well be entrusted to an assistant—occupied too much of their time.

That so many negative replies to this last question should have been received is not surprising when we consider that the range of population entrusted to one inspector—without the imposition of other duties—varied from about 50,000 to only quarter that number, showing, on the face of it, either that in the one case the work was excessive or in the other too small.

With regard to rural districts, I took area in place of population as a basis of classification, and I found in this case also that the salaries varied greatly, without any regard to the size of the districts. Also in a large proportion of cases other duties, such as those of inspectors of urban districts, rate-collectors, school attendance officers, vaccination officers, &c., were included. In four instances only, out of eighteen rural districts from which returns were received, was this not the case, and, oddly enough, two of these were the smallest districts.

I found, also, that in many cases the emoluments from extraneous work formed the greater portion of joint-salaries, and that in the case of three appointments, not only were the inspectors permitted to undertake other work, but no limit was attached to this permission. In these three instances the extraneous occupations followed were in one case "various," in another that of an architect, and in the third, that of a house and estate agent. In none of the rural districts were the inspectors allowed travelling expenses.

In one case only was any previous sanitary knowledge required, and, as in the case of the urban districts, the persons appointed had usually been policemen, farmers, clerks, &c.

In reply to the question whether the duties could efficiently be performed, no fewer than ten of the eighteen rural inspectors answered in the negative, some asserting that other duties, apart from those of an inspector, occupied too much of their time, although, at the same time, they said that if they were not permitted to undertake these extra duties there would be little left for them to live upon after paying expenses.

Now there are cases, no doubt, in which it may be necessary, owing to the smallness of districts, either to combine with adjoining districts in the appointment of officers, or to impose certain duties in addition to those which strictly speaking are included in a sanitary inspector's work. In the latter case, however, the additional work imposed should, if possible, be allied to the work of an inspector, and I throw out as a suggestion that in the appointment of registrars of births and deaths we have a means, not only of supplementing the salaries of inspectors of small districts, but also of effecting a much needed reform in public health administration. It is almost incredible that such appointments should be held by tailors, grocers, and other shopkeepers who can know absolutely nothing of what should be required of them. The work would undoubtedly be far better done by sanitary inspectors under the superintendence of medical officers of health.

Another necessary reform in this direction is the abolition of the practice which still prevails in some districts of entrusting to the police the duty of inspecting lodging-houses, slaughter-houses, &c.

To put the matter plainly, then, the views of local authorities regarding such appointments may be expressed as follows:—"There are certain appointments which must be made, involving duties which must be done, here is an appointment the duties of which are less clearly defined, let us tack it on to the others in order to help to make up one man's salary, and, if he has any time to spare after doing the essential part of his work, he can devote it to sanitary inspection."

Bad as things are, however, we have perhaps less to complain of on the ground of physical comfort, than some of our friends in the north. If those of you who may not have seen the First Annual Report of the Local Government Board of Scotland, which has just been published, will excuse the digression, I should like to quote one or two paragraphs from a report by a sanitary inspector in Skye, which is published in that document. It reads as follows:—"During the year I travelled on foot in the discharge of my duties 2,967 miles, much of the distance during the night and in stormy weather. I made 1758 inspections, disinfected 117 houses, 9 school-houses (some of them twice), and 2 meeting houses, inspected 2 fishing fleets, and 5 fish-curing stations, dealing with and effecting the removal of 5 nuisances from them.

"On two different occasions, when dealing with infected houses, I was kept out of lodgings all night without shelter during very inclement weather, walking about to keep up circulation until daylight, as I could not get on with disinfecting in the dark. I had twice to walk 25½ miles each time from infected premises to my own house during the night, once 31 miles, once 33 miles, and once from Flodigarry, by Kilmalnag and Kilmuir, to Portree, a distance of upwards of 30 miles, much of the way in the night time, as I could not get a place to lodge in, the people being so afraid of infection; but if they had as much fear of the want of cleanliness in their houses and of their persons, there would be fewer cases of infection to b afraid of.

“I had, along with Dr. Dewar, District Medical Officer, t coffin the bodies of persons dying of infectious disease, carryi the coffin between us to the cart, and drive the cart to tl graveyard; I entered fever-stricken houses, stripped down hangings, cleaned out furniture and rubbish; carried away a burned straw, hay and litter; disinfected blankets, sheets, be ding, sacks, wool and wearing apparel: carried fever patie from their beds to conveyances, drove same to hospital, carri them in and placed them in bed. Had for several nights to on hard floor of ante-room of hospital, as I would not be allow by my neighbours to enter my own house. Had to act porter and messenger at the hospital during occupancy patients, as no person on any consideration could be got in place to act. I cleaned out the beds, emptied tickings of stuffing, burning the same; disinfected and steeped blank sheets and ticking, and, with the assistance of the patie mother, washed them; attended to their drying and fold alone, as no woman would go near the work. I also receiv conveyed to, and fitted up the beds and furniture in hospital.

“District Sanitary Inspectors in other places consider t sort of work *special*, for which another man should be in h to attend to.”

Gentlemen, to return to my subject, the state of affai have described as existing in England cannot be allowed continue. It is unworthy of an enlightened community unjust to a class of men, who, notwithstanding the lu warmness of their authorities, and mostly on their own initiati have, in a most praiseworthy manner, done their best to themselves to discharge duties, the importance of which is da increasing, to expect them to remain content with the existi order of things. We have advanced so rapidly lately t there are already over 2,000 qualified inspectors in the count and few men now dream of applying for posts which entail much technical knowledge unless they can show, by credenti that they possess that knowledge. This they cannot do with considerable labour and expense, and it is unfair to expect much unless in return for adequate salaries and security tenure. What, I ask, would life and property be worth if police were similarly situated, and by doing their duty ran t risk of losing their livelihood. As in the case of the protect of life and property, in a physical sense, so in the interest public health it is unreasonable to require a sanitary inspec to be firm and consistent in the discharge of his duties, if he practically at the mercy of a body of men, many of whom are directly interested in property which he is well aware he ought to find fault with.

Endless arguments might be adduced in support of this contention, but it is quite needless to say more in addressing a body of sanitary inspectors.

So much for the disease, what is to be the remedy?

We appeal in vain to the Local Government Board for help. Whatever the cause may be that department of the Government, although perfectly well aware of the grievances which exist, does nothing to help us beyond mildly remonstrating with local authorities when their proposals overstep the bounds even of their endurance. The fact is, the department is overwhelmed with work, much, indeed most, of which has no direct relationship to public health, and it is fettered by red tape. Being already in existence as a Poor Law Authority, it was entrusted with the charge of rather a troublesome infant which has rapidly outgrown its clothes, and now having come of age is entitled to a separate and independent existence.

Sooner or later we must have a government health department, pure and simple, with a minister at its head. This is the big reform we are all hoping for, but I fear we shall have some time to wait for it, and meanwhile a means of remedying our more pressing grievances must if possible be found.

Every effort must be made to ensure that the new Public Health Act for England, which it is believed will soon be introduced, shall require that all applicants for inspectors' posts in the future shall be qualified, and that they shall have security of tenure so long as they efficiently discharge their duties. More, however, than this is wanted. We must have some guarantee that the salaries paid are adequate, and that inspectors are not dismissed from office without proper inquiry into the circumstances by an impartial, reliable, and active authority.

The Local Government Act of 1888 brought into existence County Councils, to which were entrusted, among other important administrative functions, certain somewhat limited sanitary duties, which have since been extended in important directions. Their powers, however, are permissive, and many County Councils have not exercised them, no doubt because of the idea that they are too limited in their extent to be of much service if put into operation. That this is a mistaken idea has been proved by the excellent work which those Councils who have exercised their powers have effected, and I feel satisfied that if the supervisory powers now exercised—or, rather, not exercised—by the Local Government Board were transferred to County Councils—the Central Board acting as an appeal authority—we should no longer have cause to grumble.

Most local authorities have, at any rate, a minority among their members who do not allow personal considerations to interfere with the honest discharge of their duties, and these are the men who, as a rule, are elected to represent their respective districts on the central councils. It follows, therefore, that these councils, in the main, are composed of large-minded and sensible men who do not allow private interests to stand in the way of their public duties, and who are capable of forming a just and impartial view of questions which come before them.

These, then, I suggest, are the remedies for grievances which, in the interest of public health, must be corrected, and I would urge you who are so directly concerned in the matter to leave no stone unturned in your endeavours to put an end to what is undoubtedly one of the most serious obstacles to sanitary progress. If when County Councils came into existence they had been entrusted with the same powers in this direction which the Local Government Board possesses, I have no hesitation in saying, at any rate so far as my own county is concerned, that the state of affairs to which I have called your attention to-day would years ago have been corrected.

You may not agree with me as to the means, but the end must be attained, and the more active our endeavours the sooner success will be achieved.

CONFERENCE ON DOMESTIC HYGIENE.

ADDRESS

BY THE MAYORESS OF NEWCASTLE-UPON-TYNE,

(MRS. ALBERT LORD).

IT is very gratifying to me, as Mayoress of the City of Newcastle-upon-Tyne, to have this opportunity of extending a cordial and hearty welcome to the Ladies attending the Congress of the Sanitary Institute.

I sincerely hope that those coming from distant parts of the country may have a pleasant visit to this ancient City, and may carry away with them pleasing recollections of their short sojourn here.

It is one of the oldest towns in the Kingdom, the present Chief Magistrate being the 746th Mayor. When the Diocese of Newcastle was taken out of that of Durham, in 1882, the town became a City. The old Churches and public buildings will be found interesting relics of bygone times. There is hardly a city or town in the kingdom with better architectural public buildings than Newcastle.

The dwelling-houses in the oldest parts of the City are chiefly occupied by the labouring poor, and their sanitation is far behind that of modern houses built for the same class of tenants.

These unhealthy dwellings are year by year becoming fewer, their sites being required for city improvements, and it is a very pleasing fact that the houses built in recent years for all classes are more in accordance with modern sanitary knowledge.

During the last few years the death-rate of this City has decreased, and it is satisfactory to know that we now compare favourably with the other large towns and cities of the Kingdom. The earnest and intelligent labours of the Sanitary Committee of the City Council have been rewarded by this diminution, and their continuous endeavours will undoubtedly result in a further reduction. The position of the City, on a slope facing south, and on a great tidal river, not many miles from the sea, is conducive to health, and with the exception of a small number, the people are engaged in occupations not specially detrimental to health and longevity. Much more attention is now given by all classes to sanitation, and this must produce beneficial results in the near future. The science of hygiene and sanitation generally, appeals especially to woman. She spends, or ought to spend, most of her time in household duties, and in the care of the children of the family, who are naturally most susceptible to the influences of their environment, whether sanitary or insanitary.

The great reduction in the death-rate of the country during the last half-century, is almost entirely due to the reduction of the death-rate of children under five years of age.

In conclusion, I desire to express the hope that the time may speedily come, when every family in the land, however poor, may have a dwelling which, with ordinary cleanliness, may be kept thoroughly sanitary, so that its inmates may breathe pure air, and have a plentiful supply of pure water, and to this end I sincerely trust the labours of this Congress may greatly tend.

LECTURE TO THE CONGRESS,

By A. WYNTER BLYTH, Medical Officer of Health for St. Marylebone.

CHAIRMAN OF THE COUNCIL OF THE SANITARY INSTITUTE.

THE ISOLATION OF THE INFECTIOUS SICK IN HOSPITALS.

In the history of public health in this country among the many advances none have been greater than the provision of hospitals for the infectious sick.

In 1879 no more than 20 per cent. of the local authorities had some kind of provision for the isolation of one or other of the infectious fevers. In 1892 33 per cent. of the urban sanitary authorities and 19 per cent. of the rural sanitary authorities had facilities for segregation in hospital for one or all of the following:—scarlet fever, enteric fever, diphtheria and small-pox. A return was made to the House of Commons in 1893 of various particulars relating to hospitals, and among other items of information the return gives the number of cases treated in the various hospitals up to and including 1892; by the aid of this return, supplemented by other reports, I have compiled the following tabular statement:—

Disease.	Cases calculated from Deaths. (1892.)	Cases treated in Hospital. (1892.)	Per cent. of total Cases treated in Hospital. (1892.)
Scarlet Fever ...	122,622 ...	30,488 ...	24·8
Enteric Fever ...	23,640 ...	2,710 ...	11·4
Diphtheria ...	26,208 ...	3,093 ...	11·8
Small Pox ...	5,963 ...	3,691 ...	60·2
	178,433	39,982	22·4

Hence of the diseases mentioned almost a quarter were treated in hospital. There is no return of the same kind for a later date than 1892. There can, however, be little doubt from the extension of the hospital movement during the last four or five years, that at the present time quite a quarter of the cases of the above diseases are treated in the isolation hospitals.

THE LAW AS TO HOSPITALS FOR THE INFECTIOUS SICK.

It has been rendered quite clear by the decision in the case of the Withington Local Board *v.* the Corporation of Manchester (T.L.Rep. ix. 206-224), that any person may establish a hospital, for infectious diseases, in any place. All that a sanitary authority can do to stop him would be as Mr. Justice Chitty remarked "to require plans of the building and drains to be submitted, and generally to exercise their powers in regard to infection and the like, just as in reference to any other house and building within their district, but they could not prohibit the erection and carrying on of any such hospital." At the same time it is perfectly true that after it was established, if a case could be made out against its management, and especially if it were proved that it had spread infection, an injunction could be obtained.

Few private individuals have been induced either by commercial enterprise or by charitable motives to establish isolation hospitals. Local authorities can rarely rely on external assistance. The local authorities themselves are not absolutely compelled to provide them, for the Public Health Act of 1875 did not make the hospital provision a duty; the Act, states that a local authority, *may* provide hospitals for the reception of the sick; so that local authorities have power, in the largest sense, not only to establish hospitals for the purpose of isolation, but if they choose, may erect hospitals for the treatment of disease generally.

The only special Act outside the Metropolis as to the establishment of infectious hospitals is the Isolation Hospitals Act, 1893, enabling County Councils under certain circumstances to establish isolation hospitals. The important practical point of the Act is the power given to the County Medical Officer of Health to make an inquiry as to the necessity of an infectious hospital. Under this statute there can be little doubt but that in a few years most local authorities in England will possess facilities for isolation.

UTILISATION OF INFECTIOUS HOSPITALS.

Legally only a minority of cases can be compulsorily removed to hospital. Under P.H., 1875, any person suffering from a dangerous infectious disorder without proper lodging and accommodation may be removed to hospital under a magistrate's order, presuming the hospital authorities will receive him; but the words "proper lodging and accommodation" are extremely vague, and taken in their ordinary common sense only denote that the sufferer is in a reasonably clean, ventilated, dry room, and has ordinary nursing; the words appear to take into consideration the patient only and not the possibility of danger to the public. With regard to cholera, however, the local authorities have greater powers, and when it is prevalent it is open to the Local Government Board to make very stringent regulations.

DIFFICULTIES IN ESTABLISHING NEW HOSPITALS FOR INFECTIOUS DISEASE.

The continued and, I may say, growing opposition of landowners and the public to the erection of isolation hospitals for scarlet fever and diphtheria is founded on the undeniable fact that the establishment of a new hospital in any place near inhabited houses does for a time diminish the value of those houses. A property put up at the auction mart in the vicinity of a newly-erected hospital will certainly not fetch its value. This is the fault of the public. If the public were thoroughly aware of the considerable mass of evidence in existence of the harmlessness of hospitals for infectious diseases other than small-pox—if they appreciated the fact that in no single instance has it been shown that scarlet fever or diphtheria has spread from hospitals to the immediate neighbourhood, much of this opposition would cease. Writing in 1882, Dr. Thorne Thorne* gives very strong facts as to infectious hospitals in which large numbers of scarlet fever, typhus and typhoid cases were treated. Although some of these hospitals were in the neighbourhood of schools, and all within a short distance of dense masses of population, yet the strictest inquiry could not show that there was any unusual fever incidence in the hospital environment. Look at the London Fever Hospital, which for years and years has received numbers of every kind of infectious fevers other than small-pox, no allegation that disease has spread from that institution among the large and susceptible surrounding population is ever made.

A temporary hospital was established in 1893 by the vestry of St. Marylebone, for scarlet fever in the Marylebone road, another one in a previous year in the Kentish Town road—both leading thoroughfares—in both instances large amounts of susceptible material close at hand, but again there is the same negative evidence. I know of a private hospital for scarlet fever in a large town close to a school. Again and again have the school authorities petitioned the local authority to endeavour by legal action to remove the hospital, but the medical officer of health has absolutely failed to get sufficient evidence to support an application for injunction.

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* Reports and Papers on the Use and Influence of Hospitals for Infectious Disease, Local Government Board, 1882.

The public hitherto fail to appreciate the vast difference there is between the establishment of an isolation hospital for fevers, and the establishment of a smallpox hospital, in the latter case there is considerable evidence showing that the farther the hospital from habitations in reason the better, in the former case the evidence shows that a scarlet fever hospital may be next door to a school, and if proper precautions be taken to prevent the balls, toys, &c., of convalescent children being thrown into the playground and actual contact with the scholars, no injury will result. Infection from a properly supervised scarlet fever hospital is a bugbear, a supposition disproved by experience.

The establishment of hospitals by local authorities must not be regarded solely from one point of view, viz., that of isolation: the safety of the public may be the first consideration, but the humane and skilful treatment of the patient is an equal justification for their establishment. If hospitals are established solely with the idea of stamping out infection, the results will be disappointing. Hospital accommodation for scarlet fever has controlled but not arrested epidemics, and the same holds good with respect to diphtheria. In the metropolis although a large and increasing number of the notified cases of scarlet fever are admitted promptly into the hospitals of the Asylums Board, yet nevertheless scarlet fever runs its course and recurs every few years in an epidemic form. That the prompt removal does effectually prevent spread in an enormous number of households is certain, but hospital isolation of scarlet fever in the metropolis has not had the dramatic effect of controlling an epidemic which on theoretical grounds was expected. If ten years ago any hygienist was asked the question whether scarlet fever would attain any dimensions, provided that every case was notified to the health authorities, and within about twenty-four hours of notification, the majority of cases removed to hospital and the rooms, &c., properly disinfected, the reply would have been that such measures would so effectually control the course of the disease that it could not become epidemic. Prompt notification, and as rapid a removal as practicable is in force in the metropolis. The admission into Asylums Board hospitals of scarlet fever cases has increased from 43 per cent. of the notifications in 1890 up to 63 in 1894. If the hospital accommodation had not more than once been found insufficient, a higher percentage than the above would have been attained; yet no one can say that a single metropolitan scarlet fever outbreak has been arrested. The reason, as it appears to me, why hospital accommodation for scarlet fever has not stamped out the malady will be discussed later on, at present it is sufficient to draw attention to the fact.

Although it must be allowed that scarlet fever isolation has in some directions been disappointing, isolation has on the other hand been of the highest importance and of the greatest advantage to the community. Hospitals for infectious diseases have prevented poverty, have alleviated suffering and averted death. The patients have had the incalculable advantages of skilled nursing, of excellent medical treatment. Many, who had they remained in their home environment, would have been added to the chronic invalids of the population to die at some future period of kidney disease and of various other insiduous maladies, the after effect of the scarlet fever toxine, have been discharged in perfect health. And even if it could not distinctly be shown that at all events in individual family groups the removal of the source of infection has been absolutely successful in instances too numerous to mention, it would still be the moral duty of local authorities to establish hospitals for the treatment of and isolation of scarlet fever.

WHAT INFECTIOUS DISEASES REQUIRE ISOLATION IN HOSPITAL.

For various reasons the following, almost in the order of their necessity, require special provision:—

Cholera.
Small Pox.
Scarlet Fever.
Diphtheria (including Croup).
Measles.
Typhoid or Enteric Fever.

Special accommodation is not required for erysipelas, typhus, relapsing or puerperal fevers, either because of their rare occurrence or from other circumstances; besides which, the accommodation prepared for the first list may on occasion be utilised for the last-mentioned maladies.

Cholera.—It is highly satisfactory to know that 53 out of 60 ports are at present provided with means of isolation for cases of cholera. Cholera is a disease in which the earlier cases must be at once removed to hospital, not so much for the sake of the patient as the community. It has been shown that for many days, and even weeks, after the violent symptoms have passed away, the convalescent cholera patient continues to be a breeding ground for the comma bacillus. That is to say, the minute parasite which is intimately associated with the malady continues to multiply in the intestines of the sufferer although he may apparently be in fair health. It is therefore obvious that such a person is dangerous to the public, and should be imprisoned in hospital until careful bacteriological and clinical investigation shows that he is free from the last traces of the disease.

The number of beds available throughout the country for the reception of cholera is necessarily small, and should unfortunately the first line of defence be broken down, and cholera be ever epidemic, hospital isolation will of course be impracticable save on so limited a scale as to cease to have much controlling power.

Small-pox.—The good effect of hospital isolation is never seen to greater advantage than in the case of small-pox. It is almost the only malady in which experience has proved prompt hospital isolation combined with disinfection and vaccination, can nip it in the bud. Year by year the traveller, the tramp, and the inmates of philanthropic shelters, introduce small-pox into the various parts of the metropolis, often at several points simultaneously, but owing to the finest ambulance and hospital organisation in the world it seldom spreads beyond some small area in which the disease first manifested itself.

A striking example of the arrest of an epidemic of small-pox, is that of the outbreak in St. Marylebone in 1894.

This outbreak is referred to as follows, in the report of Dr. Ricketts, the Medical Superintendent of the Small-pox Hospital Ships:—" In the first week of July (1894), there seemed to be every prospect of small-pox rapidly subsiding in London. In no part of London was the disease especially rife, and the number of daily admissions was fast decreasing, it was, therefore, with surprise, that it was heard, on the removal of four cases from the parish of St. Marylebone on the 23rd of July, that these cases would probably be followed by a large number of others. On the 24th of July fourteen cases of small-pox were admitted from this parish, on the 25th no less than thirty-six; one hundred and twenty-four cases were admitted from the parish from the 23rd to the 31st July. The cause of this alarming outbreak was not at first apparent. Only three cases had previously been removed from this parish in the course of the year. These were all isolated cases, between which and the present outbreak there was no apparent connection. The great majority of the cases were removed from a small area in St. John's Wood, lying north east of High Street, and comprising Henry Street and the streets leading into and surrounding it. It was stated by some of the patients, that a man had recently died in Henry Street. This man it appeared, from information communicated by Mr. Wynter Blyth, the Medical Officer of Health for St. Marylebone, was notified as suffering from small-pox on July 6th, died on July 12th, and was buried on July 16th. He was the son of a grocer living in Henry Street, and was not removed on account of the severity of his illness. He had been nursed by his mother, who stated that she never went out or served in the shop, or indeed left the sick room while her son was ill. The father served in the shop, and was warned not to go into the sick room. Immediately after the coffin was removed from the house, the room was thoroughly disinfected. In spite of the precautions stated to have been taken by the family, there can be very little doubt that this case was the cause of the sudden outbreak. I found that a large number of the patients first admitted, were in the habit of dealing at the shop. The date on which the rash appeared in those patients who fell ill earliest, was the 21st of July, and it is a remarkable fact, that in the week succeeding this date, the rash appeared in no less than one hundred and seventeen cases. Allowing a sufficient time for the incubation period of these cases, it is difficult to avoid the conclusion that the case referred to above was the cause of the outbreak. In August eighty-seven cases were removed from the parish of St. Marylebone. The majority of these cases however, did not come from St. John's Wood. Only twenty cases were removed from this neighbourhood in that month, and the disease was then practically stamped out there. Indeed, this local epidemic disappeared with a suddenness as surprising as that which it had appeared. A happy result due to the energy of the Medical Officer of Health and the Vaccination Officers, as well as to the promptness with which the cases were removed. Such a sudden strain has seldom, I imagine, been thrown on the ambulance service of the Managers, and the manner in which the call was responded to, is a testimonial to the excellence of its organisation."

The suppression of the Marylebone outbreak is an example of what can be done in the case of a sudden dangerous outburst of small-pox with an ambulance service and proper hospital accommodation. On the other hand the history of the Gloucester epidemic is an equally striking example of lack of the necessary appliances to remove the first crop of cases and effectually isolate. There is no town in the kingdom in which a similar burst of small-pox may not occur at any season of the year. To wait until the burst comes is useless. Advertisers portable hospitals make statements to the effect that the structures can be put up in twenty-four hours. In practic when you have to get a site—to furnish, to provide nurses, a all appliances for treatment; if the simplest structure can erected and actually ready to receive patients in twenty-fo weeks you will have not done badly. Hospitals are bound be at hand, always ready, and a small permanent skilled nursi staff. If no patients are received for two or three years succession, all the better, the expense of maintenance necessarily small. The chronicles of local authorities abou with instances of temporary hospitals erected at considera expense during the urgency of an epidemic, and by the time t buildings were completed the epidemic had burnt itself out a the buildings were not used.

Dr. Thorne Thorne, writing in 1882, with respect to h pitals put up in panic for the purposes of meeting a prese epidemic, said :—

> "Few of these hospitals have a satisfactory after-histo Some of them never received a patient of any kind; oth have been found, upon their first use, so unsuited for th purpose that it has not been thought worth while to keep th in common repair. A third set having been used for small-p would be available, it was expected, for the isolation of cases scarlatina, but it was found that people did not dread scar fever enough to let their relatives and children be taken aw to a tarred shed of repulsive aspect, such as had sufficed for t district hospital when small-pox was in question."*

MORTALITY OF SCARLET FEVER IN RELATION TO LOCALI

Scarlet Fever.—The prevalence as shown by the mortality scarlet fever has a striking connection with density on are density on area has also a relation to industry, to manufacturi or mining pursuits, hence it is found that in counties wh there are large masses of population, scarlet fever is more r and more fatal than in agricultural counties. Theref ample hospital provision for scarlet fever should be made in industrial towns.

During the decennium 1880-90, the rate of mortality children under five years of age in England and Wales p million living was 1669.

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* Reports and Papers on the use and influence of hospitals for infecti diseases. Local Government Board, 1882.

The following eleven large registration districts were much above the average :—

	Annual Death-rate per million from scarlet fever of children under five years of age.	Persons to an acre.
South Wales	2,741	2·80
Yorks. West Riding	2,600	0·76
Lancashire	2,454	0·35
Monmouthshire	2,396	1·55
East Riding Yorkshire	2,297	1·82
Durham	2,135	0·81
Nottingham	2,010	1·31
Leicestershire	1,921	1·56
London	1,780	0·02
Staffordshire	1,725	0·73
Derbyshire	1,725	1·36

Excluding South Wales (the large acreage per person of which depends on tracts of mountainous country and therefore does not represent the real living space) the average acreage per person is 1·03.

This tabular statement may be contrasted with the facts concerning the following eight counties in which the mortality of children under five years of age is much below the average.

	Deaths per million from scarlet fever of children under five.	Persons to an acre.
Suffolk	455	2·64
Westmoreland	487	7·71
Hants	505	1·69
Sussex	552	1·81
Wilts	583	3·22
Huntingdonshire	668	4·01
Kent	693	1·28
Berks	696	2·23

The average acreage for these eight counties per person is 3·06, or about three times that of the districts with the higher mortality.

If Westmoreland be excluded for similar reasons to those given for the exclusion of South Wales then the average comes out at 2·4 or double the space in the districts of high mortality. The eight counties of low mortality have a large agricultural population, the eleven districts of high mortality are all districts in which there are masses of artisans engaged in manufacturing, mining and other pursuits.

FATALITY OF SCARLET FEVER IN DIFFERENT HOSPITALS.

Scarlet fever exhibits striking differences in lethality, according to age and also to sex, so that in comparing the fatality in different hospitals the crude rates are untrustworthy. It is essential that the cases should be at least dissected into age groups. When, however, this is done, the rates at various hospitals differ so much as to need serious examination.

The Asylum Board hospitals have received a greater number than any hospital in the kingdom. The following is a statement of the fatality in per cent. of the cases admitted, based on 50,510 cases admitted from 1892 to 1895 inclusive.

Ages.	Males fatality per cent. of admissions.	Females fatality per cent. of admissions.	Combined fatality per cent. of admissions.
Under 5	14·8	13·9	14·3
5—10	3·7	3·4	3·6
10—15	1·3	1·5	1·4
15—20	1.6	1·6	1·6
20—25	0·9	1·9	1·4
25 and upwards	2·6	2·2	2·4
Totals ...	6·3	5·8	6·0

I am indebted to Dr. Russell, of Glasgow, for the follow tabular statements of the case fatality in the Glasgow Fe Hospitals :—

City of Glasgow Fever Hospital—Parliamentary Road.
Cubic Space.

	Total Cubic Contents.	No. of Beds at 2000	1500	*1250	10
Old Wards—					
Acute	16,490	8	11	13	16
Convalescent	7,946	4	5	6	8
TOTAL...	24,436	12	16	19	24
New Wards (Large)—					
Acute	26,891	13	18	22	26
Convalescent	14,142	7	9	11	14
TOTAL...	41,033	20	27	33	40
New Wards (Small)—					
Acute	23,955	12	16	19	24
Convalescent	11,007	5	7	9	11
TOTAL...	34,962	17	23	28	35

* Minimum without special orders.

8th October, 1894.

City of Glasgow Fever Hospital—Belvidere.
Cubic Space.

Dimensions—Acute: 56′3″ × 19′ × 22′ = 23,512
Do. —Convt.: 24′ × 19′ × 22′ = 10,032

33,544

Wards.	Total Cubic Contents.	Original.	No. of Beds at			
			2000	1500	1250	1000
te	23,500	11	12	15	19	23
valescent	10,000	4	5	7	8	10
TOTAL...	33,500	15	17	22	27	33
		(1)	(2)	(3)	(4)	(5)

Standard to be observed in various Wards designated.

1.) Small-pox, typhus, and diphtheria.

2.) Enteric fever, puerperal fever.

3.) Scarlet fever, erysipelas to be maintained as long as ible, and reduced to (4) only under pressure and with the tion of the Medical Officer of Health.

4.) Measles, whooping cough to be maintained as long as ible, and reduced to (5) only under pressure and with the tion of the Medical Officer of Health.

N.B.—Any question of deviation from these instructions to eferred to the Medical Officer of Health.

1*st June*, 1896.

CITY OF GLASGOW FEVER HOSPITALS.

Scarlet Fever.—Return showing the Number of Cases Treated and the Deaths in each year from 1892–3 *to* 1895–6: *also the Total Number of Cases Treated, the Total Deaths and the Mortality per cent. in the Four years* 1892–3 *to* 1895–6.

Ages.	1892—3.						1893—4.						1894—5.						1895—6.						4 Years 1892—3 to 1895—6.								
	Males.		Females.		Both Sexes.		Males.		Females.		Both Sexes.		Males.		Females.		Both Sexes.		Males.		Females.		Both Sexes.		Males.			Females.			Both Sexes.		
	Treated.	Died.	Treated.	Died.	Treated.	Died.	Treated.	Died.	Treated.	Died.	Treated.	Died.	Treated.	Died.	Treated.	Died.	Treated.	Died.	Treated.	Died.	Treated.	Died.	Treated.	Died.	Treated.	Died.	Mortality per cent.	Treated.	Died.	Mortality per cent.	Treated.	Died.	Mortality per cent.
Years.																																	
Under 1	31	8	19	5	50	13	16	5	16	1	32	6	17	2	15	3	32	5	11	4	16	3	27	7	75	19	25·3	66	12	18·2	141	31	22·0
1 & under 2	53	16	52	12	105	28	45	8	45	9	90	17	43	7	29	8	72	15	44	11	27	7	71	18	185	42	22·7	153	36	23·5	338	78	23·1
2 " 3	114	15	110	14	224	29	91	14	77	11	168	25	93	12	81	12	174	24	72	12	66	11	138	23	370	53	14·3	334	48	14·4	704	101	14·3
3 " 4	116	13	157	19	275	32	86	13	123	26	209	39	138	16	124	12	262	28	132	10	128	9	260	19	472	52	11·0	532	66	12·4	1004	118	11·8
4 " 5	155	17	174	18	329	35	139	10	111	7	250	17	92	7	109	6	201	13	105	10	130	7	235	17	491	44	9·0	524	38	7·3	1015	82	8·1
5 " 10	617	34	746	27	1363	61	519	26	564	24	1083	50	487	20	602	12	1089	32	480	15	533	24	1013	39	2103	95	4·5	2445	87	3·6	4548	182	4·0
10 " 15	244	7	364	9	608	16	195	...	225	6	420	6	208	2	231	3	439	5	178	1	236	5	414	6	825	10	1·2	1056	23	2·2	1881	33	1·8
15 " 20	99	2	134	2	233	4	75	3	97	1	172	4	82	3	115	2	197	5	60	...	83	1	143	1	316	8	2·5	429	6	1·4	745	14	1·9
20 " 25	60	1	79	...	139	1	37	2	70	1	107	3	75	1	70	3	145	4	43	1	43	...	86	1	215	5	2·3	262	4	1·5	477	9	1·9
25 " 30	40	1	34	...	74	1	25	...	29	5	54	5	30	1	28	1	58	2	22	2	28	2	50	4	117	4	3·4	119	8	6·7	236	12	5·1
30 " 35	13	...	17	...	30	...	8	1	17	...	25	1	20	...	16	1	36	1	12	...	16	2	28	2	53	1	1·9	66	3	4·5	119	4	3·4
35 " 40	8	...	8	...	16	...	2	1	5	1	7	2	6	1	4	1	10	2	5	1	9	...	14	1	21	3	14·3	26	2	7·7	47	5	10·6
40 " 45	2	1	3	...	5	1	5	...	2	...	7	...	7	...	1	...	8	...	1	...	4	...	5	...	15	1	6·7	10	...	...	25	1	4·0
45 " 50	1	...	1	...	2	...	...	...	1	...	1	...	1	...	4	...	5	...	...	...	1	...	1	...	2	...	...	7	...	...	9	...	...
50 " 55	...	...	1	...	1	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	2	...	2	...	1	...	...	3	...	...	4	...	...
55 " 60	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...
Total...	1553	115	1899	106	3452	221	1244	83	1382	92	2626	175	1299	72	1430	64	2729	136	1165	67	1322	71	2487	138	5261	337	6·4	6033	333	5·5	11294	670	5·9

Hospital year, 1st June to 31st May.

The combined fatality per cent. for both sexes was therefore as follows:—

Glasgow, under 5	12·0
5—10	4·0
10—15	1·7
15—20	1·9
20—25	1·8
Over 25	4·9
Total	5·0

935 cases of scarlet fever during 1895 were admitted into the Liverpool hospitals, and the following was the incidence of mortality:—

Ages.	Cases admitted.	Deaths.	Fatality per cent. of Admissions.
Under 5	343	44	13·1
5—10	374	9	2·4
10—15	162	2	1·2
Over 20	56	0	0
	935	55	5·8

Which is a little less than the Asylums Board mortality.*

In the London Fever Hospital during the five years 1891-1896, 2,422 cases of scarlet fever were treated there, the age distribution and per cent. fatality were as follows:—

London Fever Hospital.

Ages.	Scarlet Fever Cases admitted.	Deaths.	Fatality per cent. of Admissions.
Under 5	208	17	8·2
5—10	469	10	2·1
10—15	528	5	0·9
15—20	420	3	0·7
20—25	416	8	1·9
Above 25	381	8	2·1
	2,422	51	2·1

The Brighton Sanatorium gives very similar figures. I am indebted to Dr. Newsholme for furnishing me with the following table dealing with the admissions during the three years 1893-95:—

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* Compiled from Report of Health of Liverpool, by E. W. Hope, M.D., D.Sc., Medical Officer of Health.

Brighton Fever Hospital.—Summary Statement.

	Scarlet Fever Cases admitted.		Deaths.		Fatality per 100 Cases admitted.		
	Male.	Female.	Male.	Female.	Males.	Females.	Persons.
Under 1	5	7	1	...	...	...	...
1—2	10	14	1	1	...	...	...
2—3	40	29	3	3	...	...	...
3—4	54	46	1	1	...	...	...
4—5	48	51	3	1	...	...	...
Total under 5 ...	157	147	9	6	5·7	4·1	4·9
5—10	225	248	6	5	2·7	2·0	2·3
10—15	99	151	2	...	2·0	0·0	0·9
15—20	51	82	...	2	0·0	2·4	1·4
20—25	21	41	...	...	...	...	...
25—35	15	39	...	...	...	...	...
35—45	3	2	...	...	...	...	...
45—55	...	1	...	...	...	...	...
	571	711	17	13	2·98	1·83	2·34

Take again the Bagshot Hospital, Nottingham, Dr. Boobbyer gives in his annual report for 1895 the following tabular statement as to 1,162 cases admitted:—

	MALES.		FEMALES.	
	Cases admitted.	Deaths.	Cases admitted.	Deaths.
Under 5	157	11	172	12
5—10	234	4	253	6
10—15	96	3	104	—
15—20	32	—	27	—
20—25	10	2	16	—
25 and above	16	1	6	—
	545	21	578	18

This gives a crude death-rate of 3·4 per cent.

I am indebted to Dr. Armstrong, the Medical Officer of Health for this City (Newcastle), for the statistics relating to 1,115 patients (543 males, 572 females) suffering from scarlet fever admitted into the Hospital for Infectious Diseases, during the years 1891–5.

The fatality was as follows:—

Ages.	Male fatality per cent.	Female fatality per cent.	Combined fatality per cent.
Under 5	7·1	4·5	5·7
5—10	2·5	2·7	2·6
10—15	—	1·9	1·0
15—20	—	—	—
20—25	4·1	—	2·0
25 and above.	—	5·0	3·0
	3·1	5·0	2·9

Now if for these hospitals be calculated the deaths on the cases admitted, which would have occurred had the Asylum Board fatality prevailed, the following facts are elicited:— Theoretical and actual fatality in the Brighton Sanatorium from scarlet fever:—

Ages.	Cases admitted.	Theoretical deaths.	Actual deaths.
Under 5	304	43·50	15
10—15	473	17·02	11
10—15	250	3·50	2
15—20	133	2·12	2
20—25	62	0·87	—
Over 25	60	1·44	—
	1,282	68·45	30

Theoretical and actual fatality at the Bagshot Hospital, Nottingham, from scarlet fever.

Ages.	Cases admitted.	Theoretical Deaths.	Actual Deaths.
Under 5	329	47·05	23
5—10	487	17·53	10
10—15	200	2·80	—
15—20	59	0·94	—
20—25	26	0·36	2
Over 25	22	0·52	1
	1123	69·20	36

Theoretical and actual fatality at the Hospital for Infectious Diseases, Newcastle-upon-Tyne, 1891—95:—

	Cases admitted.	Theoretical deaths.	Actual deaths.
Under 5	279	39·9	16
5—10	485	16·5	13
10—15	200	2·8	2
15—20	73	1·2	—
20—25	45	·6	1
Over 25	33	·8	1
	1115	61·8	33

In other words, in Brighton, instead of 30 deaths, 68 would have died; in Nottingham, instead of the actual 36 deaths, 69 deaths would have occurred; similarly, in the London Fever Hospital, instead of the 2422 cases yielding 51 deaths, 76 would have died; at Newcastle 62 would have died instead of 33.*

Dr. Birdwood, writing in 1893 with regard to the mortality from scarlet fever at the North Eastern Hospital, remarks:—"The rate of mortality in this hospital—4·52 in 100—estimated from the deaths attributed to scarlet fever, is higher than it really is. The explanation of this apparent death-rate may be considered under two headings: the methods adopted for calculating the rate, and the possibility of saving some of the lives by reforms in the administration. Under the former we may

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* It would be interesting to obtain a record of scarlet fever fatality in the Continental hospitals. I have only been able to get the necessary details from the Moabite Hospital, Berlin. In five years 247 cases of scarlet fever were admitted into that Institution. The death-rates for each group of age are so greatly in excess of those in the English hospitals that either cases of great severity are alone admitted, or there must be some grievous defects in the administration.

Scarlet Fever cases admitted into the Moabite Hospital, Berlin, 1891—6.

Ages.	Persons admitted.	Deaths.	Fatality per cent.
Under 5	70	16	22·8
5—10	63	9	14·3
10—15	26	—	—
15—20	44	2	4·5
20—25	28	4	14·3
25 and over	16	3	18·7
	247	34	13·76

include in the returns of scarlet fever all patients who have had scarlet fever during their stay in hospital. Any deaths due to some other cause are counted amongst the deaths due to scarlet fever; for instance, 5 who had had scarlet fever were infected with measles, and died of measles; similarly, 2 of burns, 1 of a scald, 1 of tuberculosis, 12 of diphtheria, and 8 of various other conditions, in all 28 patients. Suppose we consider the diphtheria deaths as possibly deaths properly attributable to scarlet fever, we still have 16 deaths that should not be counted in calculating scarlet fever mortality."

Dr. Birdwood goes on to argue that when accidents or diseases supervene, then the deaths should be registered as due to those accidents or maladies, and not to scarlet fever.

It is however not alone the actual fatality, but the fatality as compared with other hospitals which is here the topic of discussion, and there is no evidence to show that at the hospitals with low mortality a different method of certification exists to that in use by the officers of the Asylums Board. The discrepancy is great between not only the small Provincial hospitals, but also between the statistics of the London Fever Hospital and those of the Asylums Board. Notwithstanding the great skill and experience in treatment and in administration, the Asylums Board hospitals do not get apparently such good results as might have been anticipated. I believe the main reason to be the massing together on the same area of diphtheritic and scarlet fever patients, and the greater frequency of intercurrent diseases, especially of diphtheria. A recent investigation shows that a large number of the throats of the scarlet fever cases in the hospitals of the Asylums Board yield cultures of the diphtheria bacillus, so that it is a question whether it is good policy to mass together in the same hospital, although in isolated blocks, scarlet fever and diphtheria patients. It appears to me that the diphtheria bacillus will grow on a scarlet fever throat without giving definite clinical evidences of its presence, yet we may surmise that small doses of the toxic products circulate through the system and enhance the mortality. This theory is capable in part of being tested, by examining an equal number of provincial patients and Asylum Board patients by bacteriological methods.

HOME AND HOSPITAL FATALITY.

There is little doubt that if a series of strictly comparable cases of scarlet fever were taken and divided into those treated in hospital and those treated at home the case fatality would be much less in the hospital cases. Dr. Hope, of Liverpool, gives the following facts as to home and hospital fatality for a series of years with regard to Liverpool:—

Scarlet Fever.

	Home Mortality.	Hospital Mortality.
1891	... 11·6 per cent.	... 6·0 per cent.
1892	... 9·3 "	... 5·6 "
1893	... 6·9 "	... 5·3 "
1894	... 6·0 "	... 5·4 "
1895	... 5·8 "	... 6·9 "

Dr. Boobbyer gives the death-rate in hospital in Nottingham for the years 1892-3-4 as 3·2 per cent. of hospital cases, 9·1 per cent. of home cases; for the year 1895 hospital lethality 3·4 per cent., home cases 11·4 per cent.; very striking figures, the value of which is, however, much discounted by not being corrected for age and sex distribution, and the surrounding circumstances. In Nottingham the numbers of home cases are also small, for in that town there has been a progressive increase in the cases isolated in hospital, the hospital isolated cases attaining in 1895 to no less than 93 per cent. of the cases notified.

DECREASE IN THE FATALITY OF SCARLET FEVER.

The decrease in mortality from scarlet fever is an accepted fact. The records alike of the Registrar-General and those of hospitals show a progressive diminution, which if it were likely to go on at the same rate would solve the question of hospital accommodation by reducing scarlet fever to an insignificant disease.

In three decades ending 1890 the mortality per million living was 1,133, 600, 335. In 1894 it had still farther diminished to 167. In the Asylums Board Statistical Report for 1895 there are some interesting tables showing the mortality in the Asylum Board Hospitals during three periods, viz.:—

(1) From 1871 to July, 1887, when patients were only admitted on the certificate of a relieving officer, or on the order of the master of a workhouse.

(2) A period (July, 1887, to end of 1891) when patients were admitted on the certificate of the poor law medical officer or of the master of the workhouse and *any* medical certificate was accepted.

(3) A notification period prior to the Public Health Act, 1891.

(4) A period also of compulsory notification but after the passing of the Public Health Act, 1891, permitting the use of the Asylum Board Hospitals within the Metropolitan area to

any person whatever their social circumstances or position free of charge.

During the first period, the case fatality per cent. admitted was 11·7, during the second 9·1, during the third 7·3, and during the last 6·0 per cent. These rates show a true diminution, for there was not sufficient differences in the age and sex distribution during the several periods to account for them.

The high mortality during the first period, is ascribed to the admission of large numbers of impoverished patients having a lower standard of vitality. This may have something to do with the question, but in a thesis on scarlet fever as yet unpublished by Dr. John T. Wilson, County Medical Officer of Health for Lanarkshire, he has shown that scarlet fever has been decreasing in fatality, not only in this country, but all over the civilised world. There has been a decrease in Rome, Brussels, Turin, Venice, Amsterdam, Rotterdam, Vienna, Prague, Buda Pesth, Stockholm, and in the United States. Scarlet fever is a pandemic malady, and its increase and decrease depend on some general cause which is obscure, the decrease is observed where there are hospitals, and where hospitals for the special treatment of scarlet fever do not exist.

WHY HOSPITAL ISOLATION ONLY CONTROLS BUT DOES NOT ARREST SCARLET FEVER EPIDEMICS.

What is the reason that prompt isolation of scarlet fever cases has so moderate an effect on prevention of the spread? Scarlet fever breaks out in a school, a large business house employing a number of young persons, in a reformatory, in a crêche, or in similar institutions, the first case is fortunately diagnosed and promptly removed, every precaution is apparently taken; three weeks (perhaps more) pass, and the danger seems over; a second case occurs and is removed, then follow cases at the end of ten days, then perhaps a burst within the usual incubation period. It appears a perfect mystery, fault is found with the disinfection, or an explanation is sought by the theory of fresh infections, and so forth. In ninety-nine cases out of a hundred careful inquiry will elicit that between the cases there have been sore throats among the inmates: if these sore throats are considered cases of scarlet fever without eruption, save indeed on the fauces, a perfect sequence of cases all within the incubation period will be discovered. I consider it an absolute fact that persons, especially those who have had scarlet fever previously, who are in short partially immune, coming in contact with scarlet fever, take the disease in so mild a form that there is no noticeable rise of temperature—no feeling of illness, but only some slight throat affection often unnoticed; these persons are able to pass the disease in various forms of severity on to other persons.

Hence the first advice to those who supervise large establishments, is to isolate all sore throats in times of scarlet fever prevalence just as severely as if they were cases of fever, and to adopt the same disinfecting precautions. Where this is rigidly done the infection is often stayed, where it is not done the infection goes on until the majority of those not immune are attacked. The secret why scarlet fever spreads is because cases of obvious and diagnosed fever are alone dealt with, while there is a mass of undiagnosed infectious matter, about which no precautions whatever are adopted. Nor does it seem clear in what practical manner a sanitary authority can deal with such cases; the appearances of scarlatinal throats offer no distinguishing mark to separate them from a host of other throat affections. No medical man can absolutely be certain that the slight redness of the fauces is a scarlatinal redness. He may infer it from the fact of scarlet fever being in the institution, but can never be certain. It may be that bacteriological study of such throats will ultimately give some help in their distinction.

Besides the above explanation of spread, the distinctly pandemic character of scarlet fever points to some obscure factor, to some recurring favouring group of circumstances by which probably the scarlatinal infection multiplies outside the human body—and until the whole life history of the scarlatinal germ is known—we shall be unable to cope with scarlatinal outbreaks with entire success.

Diphtheria.—Diphtheria kills in England and Wales between 8,000 and 9,000 persons (mostly children) annually, the fatality is about 25 per cent. or a fourth of the cases; multiply the deaths from diphtheria by four and this approximately equals the number of cases. The maximum mortality occurs in the first year of life. From fifteen years of age onwards the mortality diminishes; thus out of 6,921 patients admitted from diphtheria into the Asylums Board hospitals, the fatality rates were as follows:—

Ages.	Males. Fatality of Cases admitted.	Females. Fatality of Cases admitted.	Combined fatality of Cases admitted.
Under 5	46·6	44·8	45·7
5—10	26·2	27·4	25·9
10—15	9·5	10·6	10·1
15—20	5·4	4·5	4·8
20—25	4·7	4·0	4·2
Above 25	7·3	6·0	6·5

The local distribution of diphtheria has been studied by Dr. Longstaff,* but the most recent general view as to its geographical distribution is that given by Dr. Tatham, in the supplement to the fifty-fifth Annual Report of the Registrar-General. He states "that during the decade ending 1890, the mortality from diphtheria was equal to 168 in urban England, and to 159 in rural England per million living."

"It is noteworthy that the rate was considerably lower in the 50 smaller towns than in the rural districts, and very much lower than in the 28 chief towns. The mortality was below the mean in Rutlandshire, where the rate was 71 per million, in Staffordshire 79, in Durham 82, in Oxfordshire and Cumberland 85, in the East Riding of Yorkshire 88, and in Gloucestershire 89 per million. In 18 counties the rates were above the average for England and Wales, reaching 260 in London, 273 in Essex, and 284 in Middlesex. If instead of the all age mortality, the mortality under five years be taken into account, it will be found that as many as 32 counties, including the whole of those in the South Western, West Midland, Yorkshire and Northern divisions experienced rates below the average for England and Wales; the counties with rates above the average being mainly those of Essex, Middlesex, Hertfordshire, London, and the five counties of the South Eastern Registration Division."

Pathologists are agreed that diphtheria is a parasitic disease, the parasite being one of the many forms of bacillus, but it possesses distinctive characters which a skilled bacteriologist finds no difficulty in recognising.

The surest means of distinguishing the many obscure throat affections, and ascertaining whether they are diphtheritic in nature or not, is to take the smallest portion of mucus or membrane from the affected part, and submit it to methodical microscopical and biological examination.

In several districts this is done systematically; in St. Marylebone for example, I suggested to the local authority that every facility should be given to medical men to have their diagnosis confirmed, or the reverse, and now most cases of diphtheria notified in that district, are notified after bacteriological examination. In every hundred Marylebone cases of suspected diphtheria, the bacillus has been found in fifty-six.

Some forms of true diphtheria are horribly infective; all officers of health can give instances of whole households being rapidly infected, and in such instances the fatality is great. On the other hand a large number of cases in which, so far as bacteriological diagnosis goes are cases of true diphtheria, show but little inclination to spread and it is not uncommon for a single child to associate for many days with other children and yet not spread the malady. There is no test to distinguish the infective form of diphtheria from other forms. They must at present be treated as one. The treatment in hospital of diphtheria is necessitated partly on account of the sufferer and partly on account of the prevention of spread. A disease which in a few hours may occlude the air tube and kill a child by suffocation unless skilled assistance is at hand in order to perform either intubation or to make a hole in the air pipe below the obstruction, can never be treated at home with safety. In a diphtheria hospital a medical man is at hand night and day with all appliances. The modern treatment of diphtheria by anti-toxin is also best carried out in hospital. It is only by isolating in hospital that the tragedies which have occurred in families from diphtheria are likely to be prevented.

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* Studies in Statistics, London, 1891.

Diphtheria epidemics, however, like scarlet fever are only controlled and not prevented by removal of the notified cases to hospital. The reason for this is that the diphtheria bacillus may find a nidus in a person's throat and produce no clinical symptoms beyond a transient soreness. I have seen persons in fair physical health eating and drinking well, and with difficulty restrained from following their avocation, with just a slight redness of the fauces, scrapings of which yielded abundant crops of the diphtheria bacillus.

In the Asylums Board a bacteriological examination showed the diphtheria bacillus in a little over 36 per cent. of the cases of scarlet fever examined, and it is expressly stated that a large number of these cases showed no clinical signs of the malady.

Here we have, therefore, a parasite carried about by persons supposed by their friends and themselves to be suffering from ordinary sore throat. The majority of such cases seek no medical assistance, or, if they do, unless the physician obtains a bacteriological examination, he sees no reason to diagnose diphtheria.

This, therefore, is the main reason why hospital isolation for diphtheria is not likely to stamp the malady out: unquestionably it is good for the sufferer and beneficial to the public for the known cases to be taken into hospital, but probably the cases that are notified bear a small proportion to those that escape recognition.

Measles.—Measles, more intensely infectious, double as fatal as scarlet fever, has received but little practical attention from sanitary authorities. Scarlet fever is decreasing, measles is increasing in fatality. Scarlet fever slays nearly 8,000 children yearly, Measles about 11,000. In 1861-70 the mortality per million from measles of children under five years of age was 2,998, in 1871-80 it was 2,568, and in 1881-90, 3,131.

The striking facts as to the connection between aggregation and mortality do not apply to measles to the same extent as scarlet fever. It may, however, be stated generally that the death-rate from measles is far greater in towns than in the country. The highest rate of mortality for measles among children under five (1881-90) was in Lancashire 5,053 per million, next comes London 7,743; Staffordshire, Cheshire, the West Riding and Monmouthshire are all above the average. The lowest mortality is found in Westmoreland, Huntingdonshire, Lincolnshire and Shropshire.

Of all zymotic communicable diseases save diarrhœa, measles kills the greatest number of children in the metropolis.

To prevent a disease prompt information must be available of its existence, accordingly compulsory notification of measles should be the first step. Unfortunately, the majority of local authorities who have tried compulsory notification have, after a short trial, abandoned it. Nor is this to be wondered at; it is absolutely useless to notify measles unless the notification can be followed by some action likely either to benefit the sufferer or the public. Much of the failure is simply due to the want of hospital accommodation. In the Metropolis, for example, only one hospital, that is the London Fever Hospital, receives measles. The size of that hospital is much too small to cope with a moderate epidemic of measles, even if the whole of the beds were available. Measles, in the absence of hospital accommodation, is not likely to be notified to any extent. In some of the isolation hospitals in large towns, measles is treated, but this is rather the exception than the rule. Notwithstanding the lamentable loss of life, no one has, so far as I know, built a hospital exclusively for measles. Many of the fatal cases run their course without medical attendance, without nursing, and without any precautions whatever to prevent spread being taken, either during the malady or after its conclusion. It is perfectly true that unless hospital isolation was found to control the course of measles to a greater extent than scarlet fever, the hospital accommodation would have to be on a large scale, but then it must also be remembered that measles is not so long a disease as scarlet fever, the average period of hospital stay in the case of scarlet fever is about 70 days, whereas the average stay in cases of measles would probably be half that number, hence it is clear that a hospital which is capable of treating in the year 1000 cases of scarlet fever might be available for 2000 cases of measles.

I am of opinion that although measles is so early infective that the removal to hospital in many cases would be followed by the attack of other members of the same family, yet that it would exercise a decided influence in the control of epidemics, and that it would reduce the mortality considerably.

Enteric or Typhoid Fever.—The geographical distribution of this malady is to a considerable extent a guide to sanitary condition; areas of defective sanitation and polluted water supply are indicated by a great prevalence of typhoid. The continued advance in sanitation since 1875 is therefore strikingly shown by the steady decrease of enteric fever since that date; in the four successive quinquennia ending 1890, the death-rate per million living in England and Wales from typhoid has been as follows:—374, 277, 216, 179.

Typhoid fever is mainly a disease of adult life, whereas by far the greater part of other hospital accommodation is occupied by children. The case fatality of enteric fever is about 17·5 per cent., hence from the deaths it may be computed that at least 31,000 cases of typhoid illness occur annually. Enteric fever infection with proper nursing is more easily controlled than the other infections, so that given certain conditions hospital isolation is not a necessity. On the other hand a few cases of typhoid seem to be peculiarly infective and dangerous. In all cases, however, the discipline of a hospital conduces to the recovery of the patient. Enteric fever produces ulceration of the intestines, and in order that the ulcers may heal, a special spare diet and rest in bed is essential. Convalescent patients outside an institution are difficult to control—a single improper meal may not alone retard recovery but be fatal.

THE PROVISION OF HOSPITAL ACCOMMODATION.

It has already been stated that external assistance cannot be relied upon by Local Authorities; isolation hospitals have to be constructed from funds derived from the rates. It is therefore a first principle to construct hospitals at a moderate cost; if economy is alone to be considered the result will be poor, plain, repulsive buildings, and an entire waste of money, for the hospitals will not be utilised. The history of isolation hospital construction abounds with examples of this kind, a false economy has resulted in running up some building or buildings having the external appearance of cowsheds, and destitute of comfort within, which only the poorest class under compulsion could be induced to make use of. This is false economy. Examples of excellent construction and attractive interiors abound in the hospitals of the Asylums Board, and in most of the larger towns in this country. Take for example the isolation hospital that has been built by the Corporation of this city (Newcastle-upon-Tyne).

The most recent and palatial of isolation hospitals is the Brook hospital, Shooter's Hill, but the cost from various causes has been enormous, viz.: something like £500 per bed. If isolation hospitals are to cost anything like this sum, the over-burdened tax-payer will restrict their construction to the smallest possible accommodation. Nevertheless, the Brook Hospital will long remain a model of the practical application of the more advanced ideas in hospital construction. Without entering into details I will enumerate briefly what is accomplished in the Brook Hospital. Administrative blocks and houses completely separate from the hospital proper, so that nurses and others off duty are practically away from hospital surroundings. Buildings of so moderate a height, and with such a space between that no shadowing can occur. Provisions for destroying all refuse on the premises and for disinfecting. Separate entrances for infected and non-infected goods or persons—separate laundries for the staff and the patients—sets of isolation wards so that a doubtful case is not transferred direct to the infectious wards, the wards themselves light, airy, and cheerful, and giving the following spaces for each class of patient:—

	Scarlet fever.	Enteric & Diphtheria.
Linear wall space ...	12 ft. ...	15 ft.
Floor area	156 ft. ...	195 ft.
Cubic space	2028 ft. ...	2535 ft.

The Brook Hospital is capable of accommodating 500 patients, but in the smallest hospital none of the matters mentioned can be neglected. The most important of these is, from my point of view, the isolation wards, or what would be, perhaps, a less confusing title "quarantine wards." Mistakes in diagnosis naturally occur; a patient is certified to be suffering from smallpox or scarlet fever or diphtheria, and the disease afterwards turns out to be none of these maladies, yet, he has been removed direct to a smallpox or scarlet or diphtheria ward, and possibly within the incubation period he developes the disease, with which he has thus unfortunately been brought into contact with. To obviate this, it is essential, even in the smallest isolation hospital, to have quarantine wards to receive any patient about which there may be doubt. Where these facilities exist, it is conducive to the public interest that patients slightly affected by some illness suspected by the medical attendant to be infectious, should be received before exact diagnosis is made, on the other hand where such facilities do not exist, the medical attendant is bound to wait a sufficient time for the disease to declare itself, and during this period of expectancy probably inefficient precautions are taken and the disease spreads. Besides this obvious advantage there are others, especially the great advantage of keeping the hospital free from intercurrent diseases such as measles. A single case of measles admitted into a scarlet fever ward, will often infect half the patients in a night with disastrous results.

It is difficult to see where reduction of the cost of hospital construction can be made; there must be separation of sexes, separation of diseases, isolation or quarantine wards, and the other appliances already mentioned. There is, however, one means which I am bold enough to publicly advocate, that is the reduction of cubic space. The cubic space laid down as a minimum is 2,000 cubic feet. In the Brook Hospital as already mentioned every scarlet fever patient has over 2,000 cubic feet and 156 feet of floor space, the cubic space is obtained by making the wards 13 ft. high. If the wards were 10 ft. high it it obvious that each patient would then have 1,560 cubic feet. I do not think the floor space can be reduced without decrease of efficiency, but I am certainly of opinion that the wards, instead of the standard height of 13 ft. might be made 10 ft. It must be remembered that 70 per cent. of the scarlet fever patients are under ten years of age, that the diphtheria cases are to the extent of 72 per cent. under ten, and that cases of measles are for the most part younger still. With warm air grates, with special ventilating shafts and swing windows, if the floor space is 156 ft., a ward 10 ft. high would give as good results as 13 ft. The cost of a building is dependent, other things being equal, on its cube, and to reduce the cube of each ward by taking three feet off its height will make a considerable reduction in cost.

No evidence exists to show that 1,500 cubic feet is insufficient with good ventilation for the treatment of infectious diseases among children. There is plenty of evidence on the contrary showing that in times of pressure, infectious fevers have done well in hospitals, although housed in a less cube. More important in my eyes than excessive cubic space is ample light. It has been observed that end beds in a ward do not do so well as those more in the centre, and this has been explained by saying that such patients get less pure air, but the most refined investigation is powerless to show any difference in the air at the end of an ordinary sick ward to that in the middle; the true explanation is without doubt that the end beds are generally in the darker parts of the ward. Numerous investigations have shown that sunlight is germicidal, that pathogenic microbes are killed in sunlight with as much certainty as if they had been submitted to some strong chemical agency.

HOSPITAL ACCOMMODATION IN EPIDEMICS.

Whatever accommodation is provided, experience has shown that in epidemic times this accommodation is exhausted, for in most infectious maladies, as already stated, isolation in hospital controls but does not arrest. It is, therefore, important that sufficient land is available for extension.

The extension by means of huts or portable buildings is seldom satisfactory, and I am of opinion that it would be better where land is available to erect permanent shelters very similar to the glass and iron or glass and wood shelters of sea-side places, that is to say, light airy structures, one side entirely open facing the south, the three other sides being in part made of glass. During the whole period from May to the middle of October, the temperature will seldom fall so low as to render it undesirable for patients with plenty of bed clothing to sleep under such open structures. From May to October as a rule, the infectious diseases mentioned are most prevalent, so that this extension would take in the majority of cases. When the nights are cold but the days moderate in temperture, it might be advantageous to convey, by wheeling the beds to the shelters most of the subacute cases by day, and re-transfer them at night. During their absence a thorough purification could be made of the wards. In this way even temporary night overcrowding during the pressure of an epidemic, would not be likely to produce evil results.

To summarise the chief points of my address: —

1. The provision of due hospital accommodation in every district is a duty and necessity.

2. The local authorities and the public must not have too great expectations of the result of this hospital accommodation in arresting epidemics of scarlet fever, of diphtheria, or of measles. Epidemics are pandemic in their nature, and depend on some obscure and general cause. Probably most of the contagious living particles have a life external to the body, a life the phases and history of which are at present unknown.

3. The increasing and great fatality of measles, the general neglect of precautions to prevent its spread, point to the urgency of the joint measures of compulsory notification, and the provision of hospital accommodation for that disease.

4. The expense of efficient attractive hospital accommodation may be, without injury, slightly decreased by departing from the rules sanctioned by tho Local Government Board by giving ample floor space, but a less cube than 2000 cubic feet to children.

5. The suggestion in times of pressure as to the treatment of fevers in shelters admitting sunshine and air from the south side may, I trust, have careful consideration and practical trial.

POPULAR LECTURE,

By Sir CHARLES A. CAMERON, **Professor of Chemistry and Hygiene, R.C.S.I., and Superintendent Medical Officer of Health, Dublin.**

The Mayor of Newcastle in the Chair.

***Delivered September* 8*th*, 1896.**

WHY, WHAT, AND WHEN WE EAT.

ABSTRACT.

The lecturer after some preliminary observations in the course of which he referred to his having been present at the first Congress held by the Institute, and having presided at its Portsmouth Congress, said that he would endeavour to explain with the use of as few technical terms as possible, what food was composed of, why we used it, and what were the best times to consume it. The world was, so far as we knew, composed of about seventy elements, or simple bodies. They constituted the raw materials so to speak, with which nature built up all its rich and varied structures. The billowy ocean, the atmosphere, the vast mountain chains, the spreading fields of emerald green, the forests with their almost infinite variety of vegetable life, the nearly innumerable forms of animals, the solid crust of the earth, in a word the great globe and all which it inherits may be resolved into these few elements. What was an element? Any substance which resisted every attempt to extract from it something different from itself. For example, from chalk, two distinct bodies could be extracted, namely lime and a gas termed carbonic acid. From lime, a brilliant metal, calcium, and a gas termed oxygen could be obtained, whilst carbonic acid yielded carbon or charcoal, and oxygen gas. No one has yet extracted other bodies from calcium, carbon and oxygen, and they are therefore, at present at least, regarded as elements. Very many of the elements occurred in insignificant quantities and in very rare minerals, whilst on the other hand, the objects of everyday life, such as animals and plants, soils, ordinary rocks, air and water, were composed of little more than a dozen of the elements. Oxygen alone made up about half the weight of the surface of the globe, and probably of its interior. Disregarding traces of a few elements, animals and plants were composed of oxygen, hydrogen, carbon, nitrogen, phosphorus, sulphur, calcium, magnesium, potassium, sodium and iron. In the mineral kingdom these elements existed, in combination with each other forming water, carbonic acid, ammonia, and saline and earthy matters. It was the function of plants to organize these inert lifeless matters into vegetable structures, such as starch, sugar, gum, wood, albumen, and various other matters, of which some were used as food by animals. The lecturer explained at considerable length, how it was that the mineral bodies were converted into organic substances. Matter was indestructible, but its form admitted of protean changes. So also was it the case with the forces of nature,—heat, light, magnetism, and heat could be converted into electricity, electricity into magnetism. The great orb of day was the source of all the force or energy which operated upon earthy matter. The plant was a mere though most wondrous mechanism. It no more originated energy or force, than a steam engine, minus fuel, did. It however absorbed from the Solar beams the energy with which it decomposed water, carbonic acid, ammonia and other minerals, and recombining their elements, produced organic matter. The energy used by the plants for this purpose was not, could not, be annihilated or lost,—it remained stored up in a latent or hidden form in the vegetable matter. If the vegetable matter were converted into mineral matter, the latent energy would re-appear in some form or forms. Supposing the vegetable matter were burned in a furnace, the energy would appear as heat and light. If it were used as food by an animal, it would also be converted into mineral matter, with simultaneous evolution of heat and motive power. In the conversion of carbonic acid and water into vegetable matter, a large portion of the oxygen which these compounds contain is evolved into the air in a free state. The oxygen thus set free is capable of combining with the substances from which the plant ejected it, and of reproducing carbonic acid and water. Whenever it does this it sets free the energy which the plant had used to decompose the water and carbonic acid. A man requires to have a temperature of 98.6° F., and force is necessary to maintain the beating of his heart, his respiration and other vital functions, and to enable him to move about and perform work. The force stored up in his food supplies this heat and energy, becoming at the same time converted into mineral matter. Plants absorb carbonic acid and evolve oxygen; animals absorb oxygen and expire carbonic acid: the former organize, the latter disorganize. The food is used to repair the waste of the body, for it is chiefly the body that burns away, evolving heat and motion. This is the philosophy of food. The best kinds develop the most heat and energy, and if flavour be good are the dearest aliments.

Sir Charles next described the classification of food. The most abundant were the carbohydrates, which were composed of only three elements, oxygen, hydrogen, and carbon, the two former in the proportions in which they form water. The starches and sugars were the chief carbohydroles. They formed fats in the body, 2½ lbs. of carbohydrate producing 1 lb. of fat. The sugars were the natural food of the young, and their instinctive longing for them should be gratified. It was nonsense to say that sugar destroyed the teeth. Fats were composed of the same elements as the carbohydrates, only they contained more hydrogen and carbon and much less oxygen. They constituted a very valuable portion of our food, and their absence from a diet was a great defect. They evolved much heat and energy by their combustion in the body. The third great class of foods were the albumenoids, which in addition to the elements present in carbohydrates, contained nitrogen, phosphorus, and sulphur, and were always associated with small quantities of earthy and saline matters. Formerly, their importance was overestimated, but still they are indispensable to life, and a man requires at least 4 ozs. of them daily to keep him alive. A hard-working man will require nearly ⅓ lb. of albumen, rather more than ⅓ lb. fat, and nearly 1 lb. of carbohydrates. If he takes less fat, he requires more carbohydrates and *vice versâ*. 1¾ lbs. of wheat flour contain sufficient albuminous matter for a man, but not sufficient fat or carbohydrates, to supply which about 2 lbs. are required. 1⅛ lbs. of peas supply sufficient nitrogenous matter, but 2 lbs. are required for carbon. A diet of peas would therefore be wasteful. A mixed diet is the best, and the structure of man's teeth and digestive organs showed that he was omnivorous. Much information was given as regards purity of not only food but air, for nearly ¼ cwt. of the latter was daily taken in the body. The process of digestion was briefly explained, thorough mastication was essential, as it enabled the food to be more easily dissolved in the stomach. The lecturer descanted for some time on the importance of attending to the condition of the teeth in the case of children, and urged those who had lost their teeth to provide themselves with artificial ones. The ptyaline or nitrogenous ferment in the saliva converted starch into sugar. In the stomach the food was churned up and mixed with a nitrogenous ferment termed pepsin, which made the nitrogenous food (proteids) into soluble bodies or peptones. In the duodenum or lower stomach fats and starch were made soluble by the action of pancreatin, another nitrogenous ferment. After these changes the food became a milk-like liquid which passed into the blood and became assimilated. Regularity of time of eating was of great importance, as nature was orderly and periodicity was one of its prime laws.

The subject of the cooking of food was next discussed. If we wanted soup, meat should be put into cold water and slowly heated, delaying the process of boiling as long as possible. In this way all the soluble matters pass into the water, because the sudden application of boiling water has not coagulated and rendered the albumen insoluble. If we want meat, not soup, then we should plunge the raw meat into boiling water, and so coagulate its albumen and prevent it from dissolving in the water. Too much attention could not be bestowed upon the cooking of food, and reasons were given why the process rendered food more digestible, as, for example, by bursting of starch granules and liberating the soft starch from its very hard envelopes. The best time to take food was early in the day, at which time the vital functions and power of assimilation were at the maxima. Late meals were not as a rule so well digested as early ones. He did not believe in a man working hard for several hours before breakfast.

The subject of obesity was treated upon partly in a humorous manner. The beauty of woman was partly due to a layer of fat below the skin, which gave her the beautiful curves and softness of outline which were so much admired. As youth declined, fat usually increased, and gave that soft and comely appearance to many women who at mature age were handsomer than in their scraggy youth. It however sometimes happened that obesity became so excessive as to become an actual disease. When a man was obliged to sit on two chairs, to have to go downstairs backwards and to be unable to enter a cab, fat certainly became a great infliction. To prevent undue accumulation of fat nothing was so efficacious as exercise; the more exercise a man took the more fat he consumed. Who ever saw a fat professional pedestrian? Letter carriers and lamp lighters were rarely fat; the advantages of open-air exercises were not confined to fat persons—fat or lean people were improved in health and strength by them. The games in which ladies were now adepts, such as, for example, tennis, were great hygienic agencies. They induced the ladies to stay out in the pure fresh air by which their blood was thoroughly arterialized and purified, whilst their exercise developed their muscles. He almost thought that they were becoming taller and stronger than they were in the days of his youth, and they might ultimately progress into the remarkably tall and athletic women so graphically described by Bulwer Lytton in his "Coming Race." The lecture was illustrated by several experiments, one of which showed how people appeared when they ate too much and took no exercise, the lecturer remarking that the Mayor's face had lost its rosy hue and the Sheriff's face had become green. Votes of thanks to the lecturer and the chairman brought the proceedings to a close.

CONGRESS & EXHIBITION AT NEWCASTLE-UPON-TYNE.

The Fifteenth Congress and Exhibition of the Institute was held at Newcastle-upon-Tyne, from September 2nd to 9th, by invitation of the Mayor and Corporation. This is the second time that the Institute has visited this city, the previous meeting being in the year 1882.

Very suitable accommodation was provided for the meetings of the Congress in the University of Durham College of Medicine, the Durham College of Science, and the meeting room of the Presbyterian Church.

The Congress was received by the Mayor (Mr. Riley Lord), and his speech of welcome was responded to by H.R.H. the Duke of Cambridge (President) on behalf of the Institute, by the Right Honourable Earl Percy (President of the Congress) on behalf of the Congress, and by the Mayor of Southampton (Mr. M. Emanuel) on behalf of the delegates from the various Sanitary Authorities.

A Public Luncheon was held at the Assembly Rooms, at which the Mayor presided, and the following toasts were proposed:—

The Queen, by The Chairman.

The Prince and Princess of Wales, The Duke of Cambridge, and other members of the Royal Family, by the Chairman.

Responded to by H.R.H. The Duke of Cambridge.

The Sanitary Institute and Congress, by Mr. Alderman Newton, Chairman of the Sanitary Committee.

Responded to by Mr. A. Wynter Blyth, Chairman of Council.

The Mayor and Corporation of Newcastle-upon-Tyne, by Sir Douglas Galton.

Responded to by the Right Worshipful the Mayor and the Sheriff.

His Royal Highness afterwards formally opened the Exhibition, which was held in Olympia and the adjoining drill ground of the Northumberland Hussars, the ground having been kindly placed at the disposal of the Institute for this purpose. The Exhibition remained open until September 26th, and was visited by 51,000 people. A list of the Awards made by the judges will be found on page 343.

The first General Meeting was held in the evening of September 2nd. H.R.H. the Duke of Cambridge as President of the Institute, installed Earl Percy as President of the Congress. His Lordship then delivered the Inaugural Address. A letter was received from Sir Francis Powell, saying:

"I write one line to express my great regret that my arrangements for the autumn have placed it beyond my power to attend the Conference at Newcastle, and formally surrender the Chair to my successor. I congratulate the Congress on having secured the services of Earl Percy, whose personal qualifications, to say nothing of his social position, so eminently qualify him for the Presidential Chair.

"I cannot retire without placing on record the great gratification which I feel on the passing through Parliament by the Government of the Bill under the name of 'The Public Health' Bill. That new Act abolishes Quarantine. It may be remembered that at Liverpool I strongly urged the prompt and complete carrying out of that Reform.

"Such a measure is beyond the power of any non-official member in these days. I have, however, continually pressed both the last and the present Government, and, as the result of these exertions, can report to the Congress at the great seaport of the East Coast the amendment of the law and the destruction of an obsolete and absurd system which I advocated in the most vigorous language at my command to the Congress assembled at Liverpool.

"Wishing you a successful meeting, I remain, yours faithfully."

The business of the Congress was divided into three sections, and five Special Conferences were held. Particulars of these are given in the programme of the Congress in Part II. of the Journal. The Presidents' Addresses are published in the present number of the Journal. The papers read in the Sectional Meetings with the discussions upon them will be published in Part IV. of the present volume, and an abstract of the proceedings of the Conferences will be given in Part I. of Vol. XVIII.

During the meeting excursions were made to the Elswick Works, to Warkworth and Alnwick Castles, to Cragside, Rothbury, and a garden party was given at Jesmond Dene. Visits were also arranged to Sewage Disposal Works, Water Works, New Railways, Shipbuilding Yards, Sanitary-pipe Works, Filter Beds, Isolation Hospital, Floating Hospital, and Disinfecting Hulk.

The closing meeting of the Congress was held on September 8th, the Right Honourable Earl Percy in the Chair.

Reports of the work done in the different Sections of the Congress, and the Resolutions passed, were read by the respective Secretaries, and the Resolutions were referred to the Council of the Institute for consideration.

Proposed by Earl Percy, seconded by Dr. H. E. Armstrong, and resolved:—

"That the most cordial thanks of The Sanitary Institute and Congress are due to the Mayor, the Mayoress, and the Corporation of Newcastle-upon-Tyne for the reception accorded to the meeting and for the welcome they have given to the members in the city."

Proposed by the Chairman of the Congress Committee, Dr. J. F. J. Sykes, seconded by Dr. J. W. Hembrough:—

"That the most sincere thanks of the Congress be tendered to the President, Prof. Philipson, and the Members of Council of the University of Durham College of Medicine, the Principal, Rev. H. P. Gurney, and Council of the Durham College of Science, the Rev. Dr. Ross and the Deacons' Court of the Presbyterian Church, Colonel Cookson and the officers of the Northumberland Hussars, for the very suitable and convenient rooms, grounds, and the facilities accorded to the Congress, which have greatly enhanced the success of the meeting."

Proposed by the Sheriff of Newcastle, seconded by Sir Charles Cameron, and resolved:—

"That the hearty thanks of the members of the Congress be given to those who have so kindly shown hospitality, at private receptions, by privileges accorded to the members, at the various excursions, which have added so greatly to the pleasure and enjoyment of the meeting."

Proposed by Mr. G. J. Symons, seconded by Dr. H. R. Kenwood, and resolved:—

"That the earnest thanks of the Congress are due to the Local General Committee, the various sub-committees and the Local Secretaries, for their arduous labours in their several departments, and for their unremitting exertions in carrying out the many details in the organization of the Congress which have culminated in such a successful meeting."

Proposed by Mr. Alderman Newton, seconded by Mr. E. G. Mawbey, and resolved:—

"That the thanks of this meeting are due to the members of the Press for the full and accurate reports which have been published of the proceedings, and which are largely instrumental in the dissemination of the teachings of the Congress."

Proposed by Dr. H. E. Armstrong, seconded by Mr. Henry Law:—

"That this meeting desires to express to the Right Honourable Earl Percy, P.C., President of the Congress, their high appreciation of the great services that he has rendered in presiding over the meeting and for all the personal interest which he has so kindly displayed in its work, and in the interest of the members attending."

The numbers attending the Congress were as follows:—Delegates, 515; Members and Associates of the Institute, about 210; Associates of the Congress, 350; making a total attendance of over 1,000.

Delegates were appointed by 203 Sanitary Authorities, and by 36 Societies and Associations.

NEWCASTLE EXHIBITION.—AWARDS.

SILVER MEDALS.

Blondeau et Cie, Malden Crescent, London, N.W.
Vinolia Soap.
Brady & Martin, Northumberland Road, Newcastle.
Brady & Martin's Vacuum Tube for Rontgen Rays.
Burroughs, Wellcome, & Co., Snow Hill Buildings, London, E.C.
Disinfecting Soloids.
F. C. Calvert & Co., P.O. Box 513, Manchester.
Carbolic Acid Preparations.
Davis Gas Stove Co., 200, Camberwell Road, London, S.E.
Enamelled " Metropolitan " Gas Kitchener.
J. Defries & Sons, Limited, 147, Houndsditch, London, E.C.
Geneste Herscher Saturated Steam Disinfector.
J. Defries & Son, Limited, 147, Houndsditch, London, E.C.
Apparatus for immediately Cleaning and Sterilising Cattle Markets.
J. Defries & Sons, Limited, 147, Houndsditch, London, E.C.
Non-pressure Filters with Rapid Output.
The Expanded Metal Co., Limited, 39, Upper Thames Street, London, E.C.
Expanded Metal.

BRONZE MEDALS.

Albion Clay Company, Limited, Woodville, Burton-on-Trent.
Sykes' Deep Seal Gullies, with extra large top and 4 inch outlet.
Atkinson & Philipson, 27, Pilgrim Street, Newcastle-on-Tyne.
Ambulance Van, St. John's pattern.
Atkinson & Philipson, 27, Pilgrim Street, Newcastle-on-Tyne.
Doctor's Light Brougham.
Barnett, Rowland, & Co.,
Electric Lighting Plant.
A. Boake, Roberts & Co., Stratford, London, E.
Liquified Sulphur Dioxide.
Bowes, Scott & Western, Limited, Broadway Chambers, Westminster, London, S.W.
Corbelled Glazed Lavatory Basin.
Bowes, Scott & Western, Limited, Broadway Chambers, Westminster, London, S.W.
Automatic Flushing Grease Trap.
Brady & Martin, Northumberland Road, Newcastle-on-Tyne.
Apparatus for Demonstrating the phenomena of Heat, Sound, Light, Magnetism, Electricity, &c.
Brady & Martin, Northumberland Road, Newcastle-on-Tyne.
A Set of Standard Meteorological Instruments.
British Sanitary Company, 56, Bothwell Street, Glasgow.
Dodd's Helical Spring Bed Rest.

British Sanitary Company, 56, Bothwell Street, Glasgow.
Earth-closet.

Burroughs, Wellcome & Co., Snow Hill Buildings, London, E.C.
Syringe for Injecting Anti-toxic Serums.

Cadbury Brothers, Bournville, Birmingham.
Essence of Cocoa.

The "Cannon" Hollow-ware Co., Limited, Deepfields, Bilston.
The "Hercules" Gas Cooker.

The "Cannon" Hollow-ware Co., Limited, Deepfields, Bilston.
Enamelling Cast Iron.

John Carr & Sons, Low Lights, North Shields-on-Tyne.
Enamelled and Decorated Fireclay Tiles.

John Carr & Sons, Low Lights, North Shields-on-Tyne.
Cane Glazed Sinks.

The Cordelova Co., Limited, 74, Pitt Street, Edinburgh.
Cordelova Wall Coverings.

Crozier, Stephens & Co., 58 and 60, Collingwood Street, Newcastle-on-Tyne.
Glass with Embedded Wire.

J. Defries & Son, Limited, 147, Houndsditch, London, E.C.
Indicator of Carbonic Acid Gas in Air.

Elswick Court Marble Works Co., Northumberland Street, Newcastle-on-Tyne.
"Hotspur" Ranges (Cooking).

Emley & Sons, Limited, Westgate Road, Newcastle-on-Tyne.
Aluminium Cooking Utensils.

Emley & Sons, Limited, Westgate Road, Newcastle-on-Tyne.
Welded Conical Boiler.

Emley & Sons, Limited, Westgate Road, Newcastle-on-Tyne.
Teale's Well-fire.

Emley & Sons, Limited, Westgate Road, Newcastle-on-Tyne.
"Neville" Cooking Range with Baking Oven.

Evered & Co., Limited, 27 to 37, Drury Lane, London, W.C.
Evered's "Eveflus" Water Waste Preventer.

J. S. Fry & Sons, Limited, Union Street, Bristol.
Pure Concentrated Cocoa.

W. C. Gibson & Co., Limited, Exchange Buildings, Queen Street, Newcastle-on-Tyne.
White Enamelled Fireclay Sinks.

Wm. Harriman & Co., Limited, Fenkle Street, Newcastle-on-Tyne.
White Glazed Sinks.

Wm. Harriman & Co., Limited, Fenkle Street, Newcastle-on-Tyne.
Barron's Channel-bends with room to receive Drain Plug.

The Hedworth Barium Co., 1, St. Nicholas' Buildings, Newcastle-on-Tyne.
The St. Bede Disinfectant.

George Henry Hall, Thornton Street, Newcastle-on-Tyne.
Ambulance Van.

George J. Hutchings, 4, Clerkenwell Road, London, E.C.
Hutchings' Steam Cookers.

Wm. Ingham & Sons, Wortley, Leeds.
Salt Glazed Sinks.
George Jennings, Lambeth Palace Road, London, S.E.
Hot and Cold Water Mixer, with Indicating Thermometer.
John Jones, 40, Sydney Street, Chelsea, London, S.W.
Deep Seal Gullies, with extra large Top and 4-inch Outlet.
John Jones, 40, Sydney Street, Chelsea, London, S.W.
Improved Expanding Bag Drain Stopper.
John Geo. Kirtley, 9, St. Thomas' Street, Sunderland.
Smoke Machine for Testing Drains.
The Leeds Steel Works, Limited, Hunslet, Leeds.
Girder Flange Bar.
The London Agency, St. Mary Axe, London, E.C.
Abel Apparatus for Testing Flashing Points of Oils.
Sanitation Improvement Company, Canal Street, Wolverhampton.
Day's Stafford Closet.
Shanks & Co., Tubal Works, Barrhead, N.B.
Shanks' "Fin de Siecle" Bath, with "Modern" Waste.
Shanks & Co., Tubal Works, Barrhead, N.B.
Shanks' Urinals with Enamelled Fireclay Backs for Automatic Flushing.
The Smokeless Fire Co., Limited, 100, Shaftesbury Avenue, London, W.
Smoke Consuming Cooking Range.
Hy. Walker & Son, Limited, Westgate Street, Newcastle-on-Tyne.
Bowes' Well-fire.
Hy. Walker & Son, Limited, Westgate Street, Newcastle-on-Tyne.
New Ventilator and Draught Regulator attached to Eagle Range.
Charles Wilson & Sons, Carlton Works, Leeds.
Canopy Gas Stoves.

EXHIBITS SELECTED FOR PRACTICAL TRIAL.

British Electrozone Corporation, Limited, Trafalgar Buildings, Charing Cross, London, W.C.
Electrozone Preparations.
Richard Clarke & Co., Beehive Mills, Heckmondwike.
"Eureka" lead encased Block Tin Water Pipe.
G. & F. Couzens, 14, Tudor Street, Cardiff.
Tidal Valve Interceptor.
Crosier, Stephens, & Co., 58 and 60, Collingwood Street, Newcastle-on-Tyne.
Judge's Valve, for preventing the waste of water.
J. Defries & Sons, Limited, 147, Houndsditch, London, E.C.
Differential Gas Regulator.
J. Defries & Son, Limited, 147, Houndsditch, London, E.C.
Current Steam Disinfector.
J. Duckett & Son, Blannel Street, Burnley, Lancashire.
Ten Gallon Underground Tipper.

J. Duckett & Son, Limited, Blannel Street, Burnley, Lancashire.
Twenty Gallon Automatic Flushing Tank.
J. Duckett & Son, Limited, Blannel Street, Burnley, Lancashire.
10 Gallon Overhead Bufferless Tilting Vessel.
Emley & Sons, Limited, Westgate Road, Newcastle-on-Tyne.
Incandescent (Welsbach) Gas-light and Fittings.
O. L. Falconar, 32, Collingwood Street, Newcastle-on-Tyne.
Electric Fans, in working order, fitted in Ladies' and Gentlemen's Lavatories.
W. Fergusson & Son, Prudhoe Street, Newcastle-on-Tyne.
Champion Ventilator.
The Horsfall Refuse Furnace Co., Athenæum Buildings, Park Lane, Leeds.
Model of Refuse Destructor and Wall Diagram.
George Jennings, Lambeth Palace Road, London, S.E.
"Siphonic" Closet, without waste Preventing Supply Valve.
George Jennings, Lambeth Palace Road, London, S.E.
"Siphonic" Closet with Waste Preventing Overflow Regulating Supply Valve.
Jeyes' Sanitary Compounds Co., Limited, 64, Cannon Street, London, E.C.
Jeyes' Preparations.
Jeyes' Sanitary Compounds Co., Limited, 64, Cannon Street, London, E.C.
Jeyes' Fluid.
John Jones, 40, Sydney Street, Chelsea, London, S.W.
Ball Valves.
John Jones.
Stopper to Clearing Arm of Intercepting Trap.
John Jones, 40, Sydney Street, Chelsea, London, S.W.
"Sydney" Water Waste Preventer.
The Killgerm Co., Limited, Cleckheaton.
Killgerm Co.'s Preparations.
The Killgerm Co., Limited, Cleckheaton.
Killgerm Fluid.
Lever Bros., Limited, Port Sunlight, Birkenhead.
"Lifebuoy" Royal Disinfectant Soap.
The "Cannon" Hollow-ware Co., Limited, Deepfields, Bilston.
Chemically Enamelled Iron Evaporating Bowl.
The "Loco" Draining Apparatus Co., Limited, 25, Cross Street, Manchester.
"Loco" Lavatory Basin, with Self-flushing Overflow Pipe.
The London Agency, St. Mary Axe, London, E.C.
Petroleum Products.
Ness & Co., Darlington.
"Thymo-cresol" Disinfecting Soap.
Ness & Co., Darlington.
"Thymo-cresol" Disinfecting Fluid and Powder.
The North Eastern Glazed Brick and Tile Co., Limited, 8, Railway Arches, Westgate Road, Newcastle-on-Tyne.
Opalite.

SHANKS & Co., Tubal Works, Barrhead, N.B.
Shanks' Instantaneous Water-heaters.
SHANKS & Co., Tubal Works, Barrhead, N.B.
Shanks' Simple "Barrhead" Siphonic Closet.
JAMES STOTT & Co., Vernon Works, Oldham.
"Stott Thorp" Reflex Light and Ventilating Sun Burner.
JAMES STOTT & Co., Vernon Works, Oldham.
The Stott Gas Governor.
JAMES STOTT & Co., Vernon Works, Oldham.
The "Stott" Power Driver and Electric Air Propellers.
THRESH DISINFECTOR Co., Chelmsford.
Portable Disinfecting Apparatus.
THE THRESH DISINFECTOR Co., Chelmsford.
Thresh Current Steam and Disinfecting Apparatus.
THE TORPEDO VENTILATOR Co., 32, Eyre Street, Sheffield.
Torpedo Ventilator, Upright Pattern.
THE TORPEDO VENTILATOR COMPANY, 32, Eyre Street, Sheffield.
Torpedo Ventilator for Ships.
THE TORPEDO VENTILATOR COMPANY, 32, Eyre Street, Sheffield.
Torpedo Ventilator for Soil-pipes and Railway Carriages.
HY. WALKER & SON, LIMITED, Westgate Road, Newcastle-on-Tyne.
Connel's Flue Ventilator.
H. WATSON & SONS, 37, High Bridge, Newcastle-on-Tyne.
Trott's Bib Valves.
H. WATSON & SONS, 37, High Bridge, Newcastle-on-Tyne.
Judge's Self-closing Springless Water Tap.
H. WATSON & SONS, 37, High Bridge, Newcastle-on-Tyne.
Lord Kelvin's Bib Valve.
H. WATSON & SONS, 37, High Bridge, Newcastle-on-Tyne.
Magnesia Plastic Coverings for Boilers.

HENRY LAW, M.INST.C.E.,
Chairman.

E. WHITE WALLIS,
Secretary.

REVIEWS OF BOOKS.

"DISINFECTION AND DISINFECTANTS."*

Since the passing of the Public Health Act, 1872, which created a New Era in Local Government, there has been published quite a library of volumes—official and non-official—all being directly on subjects relating to the functions of a Sanitary Authority. One of the earliest was a Manual—the joint work of four distinguished

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* "Disinfection and Disinfectants," by Samuel Rideal, D.Sc. (Lond.), F.I.C., F.C.S., Member of The Sanitary Institute. 328 pp. Price 12s. 6d. London: Charles Griffin & Co.

[illegible] the work entitled "Disinfecti
[illegible] comprehensive account of w
[illegible] the methods and materials
[illegible] in the study of epidemics a
[illegible], as well as the establishm
[illegible], should enable us to
[illegible] comparatively exact con
[illegible] have rendered possible. Th
[illegible] of effectual disinfecti
[illegible] The work will then be d
[illegible] of being relegated, as it ge
[illegible] "Inspector" of the Sanitary
[illegible] comprehensive work, i
[illegible] than indicate its scope and
[illegible] in which the objec
[illegible] in logical order.
[illegible] considered, then the use o
[illegible] and sawdust, for the r
[illegible] or filtration, or for the abs
[illegible] micro-organisms of
[illegible] dirt, itself—receives
[illegible] is full of information
[illegible] Mr. Herbert Ransom's p
[illegible] of different fo
[illegible] of much value to the
[illegible] an account had been gi
[illegible] or cremating m
[illegible] of enteric fever
[illegible] that "dry heat machi
[illegible] in the future, and it is,
[illegible] length." The chapte
[illegible] of useful information
[illegible]

as a preliminary to sewage purification, as well as the application of doses of chemicals to infectious matters of all kinds. It is becoming daily more evident that in order to ensure an effectual and inoffensive system of sewage disposal, chemical treatment is essential. It may be added that without the assistance of skilled analysts and their intelligent assistants, systems of sewage deodorization and clarification are sure to prove unsatisfactory. In all departments of chemical disinfection therefore sanitary committees require the continuous advice and assistance of competent analysts, and those who are fitted to carry out their directions conscientiously and with intelligence. The need for "continuous control" where chemicals are in use is exemplified in the case of "disinfectants," advertised as such and as being of a certain definite strength and bactericidal activity. Dr. Rideal quotes an instance which came under the notice of Dr. Barwise, the well-known Medical Officer for Derbyshire, a short time ago, which of itself clearly shows that with disinfectants there is distinct danger to health in taking for granted the statements of advertisers and their agents.

Details are given throughout this volume of the laboratory experiments by which the germicidal properties of mercuric chloride, formalin, and other scientifically established disinfectants are based. On the other hand the information afforded the reader as to the facts actually observed in the spread of infectious diseases under known conditions of climate, season, lodgment, &c., is somewhat scanty. The study of disinfection needs to be approached from two distinct points of view, viz., experiment and observation. If the first named branch of study belongs exclusively to the chemist and bacteriologist, the second must also be regarded as the special province of the sanitary physician or epidemiologist, whose guidance in all matters relating to true disinfection is of course indispensable. Perhaps not the least valuable parts of the volume now under notice are those which tell us of the composition of various "patent disinfectants," which are so widely advertised, and which, judging from the account of this excellent authority, are many of them utterly worthless for the purpose they are supposed to serve, and consequently worse than useless to the uninformed. Briefly it may be said of Dr. Rideal's book that it represents a successful effort to bring together a large part of the information which it is essential that the advisers of sanitary authorities should have at hand, and that it is one with which at the present day those qualifying for the Diploma of Public Health may be expected to be familiar.

E. C. S.

WATER AND WATER SUPPLIES.*

This is a remarkable book, inasmuch as it is very unusual to find one in which the balance is held evenly with respect to the various branches of a subject. Perhaps it indicates the effect upon a medic man of his holding the appointment of County Medical Officer, b whatever be the explanation, except for the title page, one mig well believe that parts of the book were written by members several professions, for Dr. Thresh seems equally happy whether subject be engineering, bacteriology, geology, chemistry, medicine, (that rarest of all) common sense—*e.g.*, his chapter on wells.

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* Water and Water Supplies, by J. C. Thresh, D.Sc. (London), M.B. (Victoria), D.P.H. (Cambridge), M.O.H. Essex County Council. xvi. 438 pp., 8vo. Price 8s. London, 1896. The Rebman Publishing Co.

One great charm of the book is the clearness with which expla tions are given. For instance, at the very beginning he is spea of latent heat, and we have never seen it more clearly put tha the following words: "The same fact can be proved by ano simple experiment, which enables us also to measure the amoun heat which disappears or becomes latent. If one pint of wate the temperature of 0° C. (32° F.) be mixed with one pint of wate 79° C. (174°·2 F.), the temperature of the mixture will be the m 39°·5 C. (103°·1 F.). If, however, ice at 0° C. (32° F.) be substit for the cold water, the whole of the ice will melt, but the tempera of the resulting fluid will not be 39°·5 C. (103°·1 F.) but 0 (32° F.). Water at 0° C., *i.e.*, at its freezing point, may be said t ice plus heat. This heat, which becomes latent during the pro of liquefaction, is again given off when water freezes."

As we have said, the book is many-sided; in fact, Dr. Th discusses micrococci and the details of well-sinking, the interpreta of water analysis and the formulæ for determining the size storage reservoir, the quantity of water required by a horse o elephant or by the inhabitants of a country town, water softe and the dangers of ball hydrants, the divining rod, and the effe impure water upon health. This, by-the-bye, suggests the influ of very soft water upon lead, and through lead upon the healt some human beings. Dr. Thresh's book (though we know o other that deals with it better) seems to us less instructive on subject than on any other. We are not prepared to contest a s statement, but we hope that the evil has been regarded throu magnifying glass, and we think that details of what has been do prevent it by other towns besides Keighley would be of ge interest.

On p. 93 in the table relating to the rainfall and collected wat Massachusetts, an additional column giving the loss would be u —it would show that the variations in the last column are cl related to the total yearly rainfall. The four columns if exhibit a diagram would be instructive.

On p. 298 Dr. Thresh has quoted from Dr. Porter, who (ru away from his own profession into that of a waterworks engi has stumbled and made one deduction twice over, leading to an of about 300,000,000 gallons per annum.

We have noticed only one other essential mistake. On p. 1 heading of column two, "Kew, 1813-72," cannot be right. Observatory began work only in 1856. Probably it shoul "London," and applies to a table drawn up by the late Mr. G. I

As we expect to see this work run through several edition add a few small matters which may as well be put right. On p. 14 "Eton" should be Eaton; this results in a drollery in the index where one entry, "Eton," does duty for a place and for a person. Possibly this was intentional, for the same happens with Burton the author and Burton the town; but really the index wants looking to. If persons and places are to be in one list, and with no difference of type, it is essential that initials be given, and desirable that uniformity either in giving or omitting such designations as "Dr." should be observed. We can quite believe that Dr. Thresh was too busy personally to compile the index—but he might have looked it over. On p. 20 "Lake Vyrnwy" is quoted as a natural lake. Prehistorically it probably was, but there has been no lake there for thousands of years, and there would not be now but for the golden avalanche which Liverpool provided. On p. 45 it looks rather funny to see "Dr." Gilbert and "Mr." Lawes, and in the index it was not necessary to tell us that Sir F. Abel is "Able."

G. J. S.

NOTES ON BOOKS AND PAPERS IN TRANSACTIONS.

"Disease and Defective House Sanitation," by W. H. CORFIELD, M.A., M.D. (Oxon), F.R.C.P. *H. K. Lewis. London*, 1896. *Price 2/-*

This volume is the substance of two of the Harveian lectures delivered by the author before the Harveian Society of London in December, 1893. Various defects found in the sanitation of houses are described and the symptoms and diseases they may give rise to. The book gains additional value from the examples, which are those that have actually occurred in the author's experience, and are illustrated by some twenty drawings.

"The Imperial Health Manual, being the Authorised English Edition of the Official Health Department of Germany. Edited by Prof. ANTONY ROCHE, M.R.C.P.I., &c., 294 pp., 8vo. *Fannin & Co., Dublin; and Bailliere, Tindall & Cox, London*, 1896. *Price 2/6.*

This comparatively small Manual deals with nearly every subject that could be included in a "Health Manual." Physiology, Infectious Diseases, Rearing of Children, Occupation, Food, Water Supply, The Dwelling, Refuse Removal, Clothing, Accidents, will be found among the subjects treated. The Book is printed in a clear readable type and has numerous Illustrations.

"The Animal Tuberculoses and their relation to Human Tuberculosis." By Ed. Nocard, Professor of the Alfort Veterinary College. Translated by H. Scurfield, M.D., D.P.H. *Bailliere, Tindall & Cox. London,* **1895.** ***Price 4/-***

This volume, in 143 octavo pages, deals at fair length with the symptoms, diagnosis, pathology, and prophylaxis of tuberculosis in domestic animals. The opinions and experiments of many authorities are quoted in support of the identity of the tuberculosis of man and of animals. The translation is well done, but unfortunately the volume lacks an index.

MEETINGS HELD JULY TO OCTOBER, 1896.

EXAMINATIONS.

At an Examination for Inspectors of Nuisances, held at Cardiff on Friday and Saturday, July 10th and 11th, 1896, 42 Candidates presented themselves.

The following Candidates were certified, as regards their Sanitary Knowledge, competent to discharge the duties of Inspectors of Nuisances:—

1896, July 11.	Beaumont, Henry, Oak Cottage, St. Genydd Road, Caerphilly.
1896, July 11.	Bickle, John, 32, Southern Terrace, Mutley, Plymouth.
1896, July 11.	Brookes, James William Auston, The Surgery, Penygraig, Pontypridd.
1896, July 11.	Burr, Edwin John, 25, Strafford Street, New Town, Bristol.
1896, July 11.	Couch, William James Thomas, 12, William Square, Glebeland, Merthyr Tydfil.
1896, July 11.	Danson, John Henry, 14, Marsh Hill, Homerton, E.
1896, July 11.	Davies, Miss Julia, 8, Wordsworth Avenue, Cardiff.
1896, July 11.	Davies, William Bowen, Commercial Street, Neath.
1896, July 11.	Dolby, Alfred, 119, Grove Green Road, Leytonstone, Essex.
1896, July 11.	Durk, Charles, 80, Upper Aberdyberthi Street, Swansea.
1896, July 11.	Edwards, William Thomas Cummings, Cemetery Cottage, Tredegar, Monmouth.
1896, July 11.	Evans, James, 21, King Street, Neath.
1896, July 11.	Isaac, William, Bryngwyn Terrace, Dafen, Llanelly.

1896, July 11.	Jones William Collin, Bryn Dinas, Trealaw, Rhondda Valley.
1896, July 11.	Matthews, Ernest Romney, Town Hall, Hastings.
1896, July 11.	Morgan, Gwilym Lewis, Glanrhondda Hotel, Pontypridd.
1896, July 11.	Morgan, William Ivor, Penrice, Renoldston R. S. O., Glamorganshire.
1896, July 11.	Paynter, Joseph, Bonvilston Road, Pontypridd.
1896, July 11.	Powell, Thomas, 249, Chemicall Road, Morriston, Swansea.
1896, July 11.	Rees, Joseph Lewis, Maas-y-Berllan, Dinas R.S.O., Pontypridd.
1896, July 11.	Stephens, George Stephen, 19, Somerset Square, Redcliffe, Bristol.
1896, July 11.	Thomas, William, Gellia, Cadoxton, Neath.
1896, July 11.	Williams, Daniel Thomas, Post Office, Blaenclaydach, Llwynybia R. S. O., Glamorganshire.
1896, July 11.	Williams, David, 97, Llangyfelach, Brynhyfryd, Swansea.
1896, July 11.	Withers, Leonard Morris, 63, Ware Street, Bath Bridge, Totterdown, Bristol.

Examination Questions.

Examination for Inspectors of Nuisances.—Cardiff, July 10th and 11th. The following questions were set to be answered in writing on the 10th, and the candidates were examined *vivâ voce* on the 11th.

1.—In what circumstances can the removal of an infectious patient to hospital be enforced? Describe the method of procedure when permission to remove the patient is refused? What power is there for the detention of the patient?

2.—In inspecting a house after a case of typhoid fever, what enquiries would you make, and to what points would you particularly direct attention?

3.—What is the object of disinfection, and how is it attainable? What are the best methods of disinfecting—

(*a*) A room;
(*b*) Furniture;
(*c*) Linen;
(*d*) Clothing and bedding?

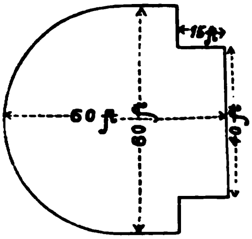
4.—What disease may be commnnicated to man from animals? Briefly describe the disease and state the animals usually affected by them.

5.—What nuisances are likely to arise from fat melting works, and how may they be obviated?

6.—What are the most important points to be observed in inspecting a cow shed and a dairy?

7.—A well is suspected to be polluted by leakage from a drain which passes within ten feet of it. Explain exactly, step by step, the kind and method of the investigations you would make.

8.—What is the content in cubic feet of a lecture room of a shape on plan and dimensions shown in the sketch, and 35 feet high?



9.—How should a scullery sink waste be led to the drain? State briefly the reason for each precaution you mention.

At an Examination for Inspectors of Nuisances, held at Leeds on Friday and Saturday, July 24th and 25th, 1896, 72 Candidates presented themselves.

The following Candidates were certified, as regards their Sanitary Knowledge, competent to discharge the duties of Inspectors of Nuisances:—

1896, July 25. Bannister, Tom, 66, Ovenden Road, Halifax.
1896, July 25. Bent, Tom, 8, Queen Street, Leicester.
1896, July 25. Bond, Ernest Henry, 24, Church Road, Waterloo, Liverpool.
1896, July 25. Bould, William, 4, Reginald Street, Burslem.
1896, July 25. Brookshaw, Samuel, 118, Corporation Street, Manchester.
1896, July 25. Bull, Richard Edward, 19, Leamington Road, Sparkbrook, Birmingham.
1896, July 25. Cooper, John Alfred Kempster, Cheetham Hospital, Huntsbank, Manchester.
1896, July 25. Craghill, Thomas Henry, 9, St. John's Hill, Shrewsbury.
1896, July 25. Crostan, James Wright, 29, Ostrich Lane, Prestwich, Manchester.
1896, July 25. de Key, John Edward Hamilton, Old Hill, Staffordshire.
1896, July 25. Dixon, Frederick, 28, Porter Street, Hull.
1896, July 25. Douglas, James Wightman, The Willows, Alnwick.
1896, July 25. Drummond, Alfred Edwin, 23, Heworth Green, York.
1896, July 25. Edwards, John Herbert, 31, Talbot Road, Wrexham.

July 25. Ellis, James, 4, Ascot Place, Leeds.
July 25. Gout, George, Beilby House, Cleethorpes.
July 25. Harrison, John William, 5, Dracup Road, Bradford.
July 25. Hastings, Miss Hannah, 18, Sanderson Road, Jesmond, Newcastle-upon-Tyne.
July 25. Hayes, Frederick William, Orleton, Worcester Road, Malvern.
July 25. Hinchcliffe, Daniel, 2, Rayner Terrace, Low Town, Pudsey.
July 25. Hobson, Ezra, Paddock House, Wadsley, Sheffield.
July 25. Hopper, George Ernest, 5, Esk Terrace, Whitby.
July 25. Jenkinson, Fred., 45, Newsome, Huddersfield.
July 25. Marshall, George Freeman, 91a, West Parade, Spring Bank, Hull.
July 25. Monson, Harold Rudolph, 21, Alexander Road, Hull.
July 25. Oakley, Dan, Croft Street, Crook, *viâ* Darlington.
July 25. Oldham, Arthur John, 29, Lefroy Street, Newcastle-upon-Tyne.
July 25. Parker, Howard, Moorlands, Buxton.
July 25. Pighills, Edmund Smith, 32, Langsdale Street, Liverpool.
July 25. Rayner, Alfred, 32, Ward Street, Hempshaw Lane, Stockport.
July 25. Reid, William, 22, Howe Street, Carlisle.
July 25. Scorrer, James Mearns, 2, Barton Terrace, Stanley Street, Hull.
July 25. Sharp, Frederick Squire, 1, Nippet Mount, Burmantofts, Leeds.
July 25. Smith, James, 21, Moseley Common, Boothstown, Manchester.
July 25. Smith, William James, 36, Coventry Road, Market Harborough.
July 25. Thackray, John William, 2, Rossington Place, Leeds.
July 25. Thorpe, William, 156, Lightbourn Road, Moston, Manchester.
July 25. Townend, Thomas, Vine Villa, Cromwell Street, Stretford, Manchester.
July 25. Tyrer, John Joseph, 33, Northumberland Street, Liverpool.
July 25. Wade, George, Sanitary Inspector, Town Hall. Manchester.
July 25. Ward, William, 132, Mount Pleasant, Shildon, *viâ* Darlington.
July 25. Westgarth, George Wilkinson, 60, Hedley Hill Terrace Waterhouses, Co. Durham.
July 25. Wilcockson, Albert Edward, 12, Andrew Street, Middleton Junction.

1896, July 25. Wildig, Hugh, Christleton, Chester.
1896, July 25. Wilkinson, Hargreaves, 124, Manchester Road, Nelson, Lancashire.
1896, July 25. Williams, Griffith, 3, Well Lane, Rock Ferry Cheshire.

Examination Questions

Examination for Inspectors of Nuisances.—Leeds, July 24th, 1896. The following questions were set to be answered in writing on the 24th, and the Candidates were examined *vivâ voce* on the 25th.

1.—When is smoke a nuisance, and how would you deal with it? What powers are possessed by Local Authorities for dealing with effluvium nuisances?

2.—How do you recognise flukes, trichinæ, tubercles, measles, and hydatid cysts in meat? What are they, and what diseases may they cause if eaten by man?

3.—What diseases may be communicated through drinking water? What are the respective merits and dangers of rain water, well water, and river water?

4.—When enquiring into the origin of a case of small-pox, what particulars would you ascertain? What steps should be taken to prevent the spread of the disease?

5.—What is the difference between a factory and a workshop? What responsibilities have Sanitary Authorities, and their officers, with regard to each?

6.—State the chief provisions of the model Bye-laws, issued by the Local Government Board with reference to the trade of a gut-scraper, a blood-boiler, a fell-monger, and a soap-boiler?

7.—What are back-to-back houses? What are their sanitary disadvantages? How may the condition of such houses be ameliorated without demolishing them?

8.—What are the important points as regards the materials, construction, dimensions, position, and course of a soil-pipe? Give your reasons for considering them important.

9.—How many inches must the water be lowered in a square tank 12 feet in diameter to fill a 6 inch drain 20 feet long?

FORTHCOMING MEETINGS.

CALENDAR, OCTOBER TO DECEMBER, 1896.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Finance Committee . . .	Second Wednesday at 4 p.m.
Exhibition Committee . . .	First Tuesday at 5 p.m.
Congress and Editing Committee .	Second Monday at 5.15 p.m.
Education Committee . . .	Third Monday at 5 p.m.
Museum and Library Committee .	Fourth Monday at 5 p.m.

OCTOBER.

1 T. Lecture to Sanitary Officers at 8 p.m. Sanitary Law; English, Scotch, and Irish, General Enactments; Public Health Act, 1875; Model By-Laws, &c., by Herbert Manley, M.A., M.B., D.P.H.

3 S. Inspection and Demonstration at the Ealing Sewage and Destructor Works at 2.15 p.m.

5 M. Lecture to Sanitary Officers at 8 p.m. The Law relating to the Supervision of Food Supply, by A. Wynter Blyth, Barrister-at-Law.

7 W. Inspection and Demonstration in the Parish of St. George's Hanover Square at 2 p.m.

8 T. Lecture to Sanitary Officers at 8 p.m. Sanitary Laws and Regulations governing the Metropolis, by A. Wynter Blyth, Barrister-at-Law.

10 S. Inspection and Demonstration at the Wimbledon Sewage Works at 3 p.m.

12 M. Lecture to Sanitary Officers at 8 p.m. Nature of Nuisances, including Nuisances the abatement of which is difficult, by Artuur Newsholme, M.D., D.P.H.

14 W. Inspection and Demonstration at the Casual Wards and Disinfecting Station, Chelsea at 3 p.m.

15 T. Lecture to Sanitary Officers at 8 p.m. Objects and Methods of Inspection, by J. F. J. Sykes. D.SC., M.D.

17 S. Inspection and Demonstration at the Express Dairy Co.'s Farm, College Farm, Finchley, at 3 p.m.

19 M. Lecture to Sanitary Officers at 8 p.m. Trade Nuisances by Prof. A. Bostock Hill, M.D., D.P.H.

21 W. Inspection and Demonstration at the East London Soap Works (Messrs. E. Cook & Co.), Bow at 3 p.m.

22 T. Lecture to Sanitary Officers at 8 p.m. Water Supply, Drinking Water. Pollution of Water, by Prof. W. H. Corfield, M.A., M.D. (Oxon).

24 S. Inspection and Demonstration at the Southwark and Vauxhall Water Works, Hampton at 3 p.m.

26 M. Lecture to Sanitary Officers at 8 p.m. Infectious Diseases and Methods of Disinfection by H. R. Kenwood, M.B., D.P.H.

28 W. Inspection and Demonstration at the Metropolitan Cattle Market, York Road, N.

29 T. Lecture to Sanitary Officers at 8 p.m. Diseases of Animals in relation to Meat Supply. Characteristics of Vegetables, Fish, &c., unfit for food, by Alfred Hill, M.D., F.R.S.E.

31 S. Inspection and Demonstration at the Works of the Richmond Main Sewerage Board. Mortlake at 3 p.m

NOVEMBER.

2 M. Lecture to Sanitary Officers at 8 p.m. Ventilation, Warming and Lighting. by Louis C. Parkes, M.D., D.P.H.

3 T. Demonstration of Diseased Meat at the Parkes Museum at 8 p.m., by W. A. Bond, M.A., M.D., D.P.H.

4 W. Inspection and Demonstration of Disinfecting and Filtering Appliances at J. Defries & Son, 147 Houndsditch, at 3 p.m.

5 T. Lecture to Sanitary Officers at 8 p.m. Principles of Calculating Areas, Cubic Space, &c.; Interpretations of Plans, and Sections to Scale, by J. Wallace Peggs, ASSOC.M.INST.C.E.

7 S. Inspection and Demonstration of Disinfecting Apparatus and Model Steam Laundry at St. John's Wharf, Fulham, at 3 p.m.

9 M. Lecture to Sanitary Officers at 8 p.m. Sanitary Building Construction, by Prof. T. Roger Smith, F.R.I.B.A.

11 W. Inspection of L.C.C. Common Lodging House, Parker Street, Drury Lane, at 3 p.m.

12 T. Lecture to Sanitary Officers at 8 p.m. Details of Plumbers' Work, by J. Wright Clarke.

16 M. Lecture to Sanitary Officers at 8 p.m. Sanitary Appliances, by George Reid, M.D., D.P.H.

18 W. Inspection and Demonstration in the Parish of St. George's, Hanover Square, at 2 p.m.

19 T. Lecture to Sanitary Officers at 8 p.m. House Drainage, by W. C. Tyndale, ASSOC.M.INST.C.E.

23 M. Lecture to Sanitary Officers at 8 p.m. Sewerage and Sewage Disposal, by Prof. H. Robinson, M.INST.C.E.

25 W. Inspection of L.C.C. Common Lodging House, Parker Street, Drury Lane, at 3 p.m.

26 T. Lecture to Sanitary Officers at 8 p.m. Scavenging. Disposal of House Refuse, by Charles Mason, ASSOC.M.INST.C.E., A.R.I.B.A.

DECEMBER.

4 F. } Examination in Practical Sanitary Science and for Inspectors of
5 S. } Nuisances, London.

9 W. Sessional Meeting at 8 p.m. Paper by S. Rideal, D.SC., F.C.S., on Soils and their suitability for Sewage Farms with the Role of Bacteria in Sewage Disposal.

18 F. } Examination in Practical Sanitary Science and for Inspectors of
19 S. } Nuisances, Liverpool.

MEMBERS AND ASSOCIATES ELECTED.

JULY. (No Ballot held in August and September.)

MEMBERS (MEM. SAN. INST.)

* Passed Examination in Practical Sanitary Science.
† Passed Examination as Local Surveyor.
‡ Passed Examination as Inspector of Nuisances.

983 1896. July. *‡CLARKE, John Henry, *Vestry Hall, Chiswick, W.*

993 1896. July. *HERBERT, D. W., ASSOC.M.INST.C.E., *c/o Grindlay Groom & Co., Bombay.*

988 1896. July. *North, Edward, 6, *Grove Road N.*, *Southsea.*
986 1896. July. *‡Pike, Edmund, *Lynton*, *Bromhill Road*, *Torquay.*
987 1896. July. Shannon, Mark, D.P.H., Scotland, *Rickmansworth*, *Herts.*
991 1896. July. *Sisterson, Thomas, *May Cottage*, *Sidmouth*, *Devon.*
990 1896. July. †Stucke, William Henry, A.R.I.B.A., P.A.S.I., *P.O. Box* 2271, *Johannesburg*, *S.A. Republic.*
992 1896. July. *Wilson, Wm. Thomas, *The Royal Agricultural College*, *Cirencester.*

ASSOCIATES (Assoc. San. Inst.)

‡ Passed Examination as Inspector of Nuisances.

1417 1896. July. ‡Allen, Miss M., 1, *Lloyd Street*, *Lloyd Square*, *W.C.*
1403 1896. July. ‡Backhouse, Thomas, 122, *Ennersdale Road*, *Lewisham*, *S.E.*
1420 1896. July. ‡Clarke, James, 35, *Annis Road*, *S. Hackney*, *N.E.*
1412 1896. July. ‡De Alberti, Miss Amalia, 42, *Cotleigh Road*, *West Hampstead.*
1416 1896. July. ‡Ede, W. J., 20, *Norfolk Road*, *Brighton.*
1409 1896. July. ‡Fairchild, Thomas A., *High Road*, *Upper Clapton.*
1424 1896. July. ‡Frame, A., 16, *The Albany*, *Camberwell*, *S.E.*
1414 1896. July. ‡Franklin, Edward, 45, *Crowndale Road*, *N.W.*
1423 1896. July. ‡Halstead, Wm. D., 229, *Lytham Road*, *South Shore*, *Blackpool.*
1427 1896. July. ‡Kelsey, Mrs. Caroline Eliza, 13, *Berkeley Road*, *Crouch End*, *N.*
1415 1896. July. ‡Lovell, Samuel George, 73, *The Crescent*, *South Tottenham.*
1406 1896. July. ‡Males, Nelson, 191, *Albany Street*, *N.W.*
1413 1896. July. ‡Masters, William Henry, 21, *Whitfield Street*, *W.*
1419 1896. July. ‡Nicholson, Thomas, 41, *Newbury Road*, *Bromley*, *Kent.*
1410 1896. July. ‡Parker, Harry Edward, 62, *Cecil Road*, *Upton Manor*, *Plaistow*, *E.*
1426 1896. July. ‡Prosser, Albert W. Gregory, 17, *Brereton Road*, *Bedford.*
1422 1896. July. ‡Radcliffe, Albert E., 3, *Albert Villas*, *Lindley Road*, *Leyton.*
1411 1896. July. ‡Roberts, George, 14, *Milton Road*, *Herne Hill*, *S.E.*
1421 1896. July. ‡Sanderson, James, 15, *St. John Street*, *Islington*, *N.*
1425 1896. July. ‡Smith, William, 19, *Barnsbury Grove*, *Islington*, *N.*
1407 1896. July. ‡Stafford, Henry, 30, *Mill Road*, *Lewisham.*
1418 1896. July. ‡Wigley, Alfred, 12, *Winston Road*, *Stoke Newington.*
1405 1896. July. ‡Winn, Wm. Warren, 12, *Grove House Road*, *Hornsey*, *N.*

OBITUARY.

Sir GEORGE MURRAY HUMPHRY, M.D., F.R.S.

(VICE-PRESIDENT.)

The death of Sir George Murray Humphry has deprived Cambridge of one of her greatest men, and the country of one its ablest Surgeons. Of the debt that the world owes to him as a Surgeon, and of the history of his career, others have written. Trained by Lawrence and Paget he was a worthy pupil of great teachers, and the combination of gentleness with force of character which he possessed made him the remarkable and attractive man he was.

But here we must especially notice his connexion with Public Health work. Co-founder with Sir George Paget of the Medical School at Cambridge, as it now is, he was one of the first to see the importance of Public Health work, and the necessity for the Medical Profession to keep abreast of it, and he used his great influence to induce his University to inaugurate an Examination in subjects relating to Public Health as long ago as 1878: this Examination was continued annually for some years, and has since been held biennially, and other examining bodies have taken it as their model.

Indeed, Sir George Humphry so far identified himself with Sanitary work, as to accept the position of Vice-President of the Sanitary Institute, which he held up to the time of his death, and also the Presidency of its Congress held in Glasgow in 1883. Sir George also carried out a most laborious investigation on the phenomena of old age, in which he spared no trouble in getting personally the particulars of the cases he inquired into, often travelling considerable distances for that purpose, so that the results of this research are absolutely reliable, and of great value.

He was himself a remarkable example of hale old age, and time apparently had little effect on him. As a host he was without a rival, and on the occasions of the Public Health Examinations at Cambridge, he would invite several or even all of the Examiners to stay at his house, as if he felt that that Examination was a child of his and that he must look after it. These meetings will be looked back upon by those who were privileged to take part in them with the greatest pleasure mingled with an equal regret that our accomplished, witty and genial host has departed.

W. H. C.

MR. R. W. PEREGRINE BIRCH, M.INST.C.E.

(FELLOW.)

We have to note with much regret the death of Mr. Robert William Peregrine Birch, which occurred at Foyers, on Loch Ness, on August 30th, after a very short illness. Mr. Birch joined the Institute in 1878, and had been an active member of the Council since 1888. He was one of the Examiners, and also one of the Judges of the Exhibition, and served on other standing Committees of the Institute.

Mr. Birch was well known as a hydraulic engineer, and had taken a prominent part in many Parliamentary enquiries relating to Water Supply.

CONTRIBUTIONS AND ADDITIONS TO LIBRARY

DURING JULY, AUGUST AND SEPTEMBER, 1896.

⁂ *For publications of Societies and Institutions, &c., see under "Academies."*

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NOTES ON LEGISLATION AND LAW CASES.

QUEEN'S BENCH DIVISION.

Before the LORD CHIEF JUSTICE and Mr. JUSTICE WILLS.

SPIERS AND POND (LIMITED) *v.* BENNETT.

"*Times*" *Law Report*, *May 6th*, 1896.

Case stated by a Metropolitan Police Magistrate.

At a Court of Summary Jurisdiction a complaint preferred by Albert Bennett, a Sanitary Inspector charged with the execution of the Sale of Food and Drugs Acts (hereinafter called the Respondent), against Spiers and Pond (Limited) (hereinafter called the Appellants) under Section 9 of the Sale of Food and Drugs Act, 1875 (38 and 39 Vic., cap. 63), charging that they, the Appellants, on September 25th, 1895, at Farringdon Street Station, in the parish of St. Sepulchre, in the county of London, did unlawfully sell a certain article—to wit, milk—from which the fat had been abstracted by skimming or otherwise to the extent of at least 17 per cent. without disclosing to the purchaser such abstraction or alteration, contrary to the provisions of Section 9 of the said Act, was heard and determined. At the hearing before the magistrate the following facts were either admitted or proved:—That on the said September 25th, 1895, at about 2.30 p.m., the Respondent entered the said premises, walked up to the counter, and requested to be supplied with a glass of milk, and that an assistant of the Appellants thereupon poured out a glass of milk from a churn standing on the said counter and handed it to the Respondent. That the milk was obtained from the churn by means of a tap, but the churn was so constructed that no milk would flow from the tap unless and until, by pressing a knob or button at the top of the vessel, a piston-rod or "dasher" descended to and reached the bottom. The object of this arrangement was that the milk and cream therein should be kept properly mixed together. That the milk on flowing from the tap was received and was supplied to the Respondent in a glass whereon were distinctly written in a blue colour the words, "Not guaranteed as new or pure milk or with all its cream: see notices." That on the counter, at the distance of a few feet from the place where the Respondent was standing when he was served with the said milk and facing the entrance to the said refreshment rooms from the street, was placed a framed notice, which was in the following words:—"Milk Notice.—Spiers and Pond (Limited) purchase all milk sold by them under a warranty of its purity and genuine quality, and take all possible precautions to insure its supply to their customers in proper condition; but they are unable to guarantee it as either new, pure, or with all its cream, and (to meet the requirements of the Sale of Food and Drugs Act) do not, therefore, sell it as such." It was stated by the Respondent that he saw the writing on the glass in which he had been served for the first time whilst he was in the act of dividing the milk for the purpose of fulfilling the requirements of Section 14 of the Act; but that he did not see the notice on the counter until his attention was called to it by the Appellants' assistant immediately afterwards. That the milk, on being submitted to analysis, proved to be deficient in cream to the amount of 17 per cent. It was proved on behalf of the Appellants that the only milk supplied to the Appellants' said refreshment rooms was supplied to them by the London and Provincial Dairy Company, and that a servant of the Company, at 7 a.m. on September 25th, 1895, brought four quarts of milk in a can which was not locked or sealed to the said premises and placed it on the counter: that no other milk was brought to the said premises on that day before the Respondent visited them; that upon the arrival of the milk, the Appellants' assistant, after washing out the churn with hot water, poured into it the contents of the can until the churn was completely filled; and that the portion of the milk remaining in the can after the churn was completely filled was poured into two jugs and sent down to the kitchen of the said premises. It was further proved on behalf of the Appellants that a contract had been entered into in writing on September 18th, 1894, between the Appellants and the Dairy Company for the supply of milk to various London establishments (including the said refreshment rooms) belonging to the Appellants during a period of twelve months from October 1st, 1894, and that a warranty in writing, forming part of the said contract, had been given by the Dairy Company to the Appellants, which was in the words following:—

"To Spiers and Pond (Limited).—We, the undersigned, hereby warrant that all milk that shall be supplied by us to you shall be new milk in good condition, pure, and unadulterated, in the same state as when taken from the cow, without the addition of water or any other substance, and without the abstraction of cream or any other constituent part of the milk.

"London and Provincial Dairy Company,
"Halkin Street, West Belgrave Square,
"London, S.W.

"Date, September 22nd, 1894."

It was contended for the Appellants (*inter alia*) that the writing on the glass, together with the notice on the counter, constituted a sufficient "disclosure of the alteration" within Section 9 of the Act. On behalf of the Respondent it was contended (*inter alia*) that the said notice and the said inscription on the said glass did not constitute a sufficient "disclosure of the alteration" within the meaning of Section 9 of the Act. The magistrate was of opinion that, there having been an alteration in point of fact, the notices were only in the nature of a refusal to guarantee the quality of the milk, and did not, therefore, constitute a sufficient disclosure of the alteration within the meaning of Section 9 of the Act, and convicted the Appellants, and imposed a penalty of 40s. and £3 3s. costs. The question for the opinion of the Court was whether the Appellants were legally and properly convicted of the offence charged in the complaint.

The **Lord Chief Justice**: There is no evidence that the Appellants abstracted anything.

Mr. **Channell**, Q.C. (for the Respondent): I admit there is no evidence if the onus of proving that the Appellants abstracted the cream is on the prosecution.

The **Lord Chief Justice**: What more can they do? There was no knowledge of any alteration, if any alteration in fact took place.

Sir E. **Clarke**, Q.C. (for the Appellants): In consequence of the case of "Dyke *v.* Gower" (1892, 1 Q.B., 220) the Appellants have taken the precaution to put up the notices. We are not within Section 9 at all, because there has been notice, and therefore diclosure. Unless this notice is held sufficient, Messrs. Spiers and Pond must cease the sale of milk. I am at a loss to imagine why a public body should start a prosecution against Messrs. Spiers and Pond at such a wicked waste of public money.

Mr. **Channell**, Q.C., for the Respondent, submitted that Sections 6 and 9 of the Act were correlative. Section 6 dealt with adding substances to the milk, Section 9 with taking away from it. Here the Appellants had not disclosed that there had been an alteration; they simply said they did not know whether it had, in fact, been altered or not. The Legislature had imposed a penalty in this case where the person was not really in default. There was no suggestion that there was any knowledge on the part of Messrs. Spiers and Pond.

Sir E. **Clarke**, Q.C., in reply, cited "Gage *v.* Elsey" (10 Q.B.D., 518); "Pope *v.* Turle" (L.R. 9, C.P., 499).

A NOTE ON THE FINAL REPORT OF THE ROYAL COMMISSION APPOINTED TO INQUIRE INTO THE SUBJECT OF VACCINATION.

The following extracts from the report give the questions referred to the Commission, with paragraphs selected from the report, which show the opinions at which they arrived.

(A)—The effect of vaccination in reducing the prevalence of, and mortality from, small-pox.

377. We have not disregarded the arguments adduced for the purpose of showing that a belief in vaccination is unsupported by a just view of the facts. We have endeavoured to give full weight to them. Having done so, it has appeared to us impossible to resist the conclusion that vaccination has a protective effect in relation to small-pox.

We think:—

1. That it diminishes the liability to be attacked by the disease.
2. That it modifies the character of the disease, and renders it (*a*) less fatal, and (*b*) of a milder or less severe type.
3. That the protection it affords against attacks of the disease is greatest during the years immediately succeeding the operation of vaccination. It is impossible to fix with precision the

length of this period of highest protection. Though not in all cases the same, if a period is to be fixed, it might, we think, fairly be said to cover in general a period of nine or ten years.

4. That after the lapse of the period of highest protective potency, the efficacy of vaccination to protect against attack rapidly diminishes, but that it is still considerable in the next quinquennium, and possibly never altogether ceases.
4. That its power to modify the character of the disease is also greatest in the period in which its power to protect from attack is greatest, but that its power thus to modify the disease does not diminish as rapidly as its protective influence against attacks, and its efficacy during the later periods of life to modify the disease is still very considerable.
6. That re-vaccination restores the protection which lapse of time has diminished, but the evidence shows that this protection again diminishes, and that, to ensure the highest degree of protection which vaccination can give, the operation should be at intervals repeated.
7. That the beneficial effects of vaccination are most experienced by those in whose case it has been most thorough. We think it may fairly be concluded that where the vaccine matter is inserted in three or four places, it is more effectual than when introduced into one or two places only—and that if the vaccination marks are of an area of half a square inch, they indicate a better state of protection than if their area be at all considerably below this.

(B)—The objections made to vaccination on the ground of injurious effects alleged to result therefrom; and the nature and extent of any injurious effects which do, in fact, so result.

434. A careful examination of the facts which have been brought under our notice has enabled us to arrive at the conclusion that, although some of the dangers said to attend vaccination are undoubtedly real and not inconsiderable in gross amount, yet when considered in relation to the extent of vaccination work done they are insignificant. There is reason further to believe that they are diminishing under the better precautions of the present day, and with the addition of the further precautions which experience suggests will do so still more in the future.

(C)—Whether any, and, if so, what means should be adopted for preventing or lessening the ill effects, if any, resulting from vaccination; and, whether, and, if so, by what means, vaccination with animal vaccine should be further facilitated as a part of public vaccination.

437. We put the use of calf-lymph in the forefront because, as we have said, this would afford an absolute security against the communication of syphilis. Though we believe the risk of such communication to be extremely small where humanized lymph is employed,

we cannot but recognise the fact that however slight the risk, the idea of encountering even such a risk is naturally regarded by a parent with abhorrence. We think, therefore, that parents should not be required to submit their children to vaccination by means of any but calf-lymph, but this should not preclude the use of humanized lymph in case they so desire.

So long as the State, with a view to the public interest, compels the vaccination of children, so long even as it employs public money in promoting and encouraging the practice, we think it is under an obligation to provide that the means of obtaining calf-lymph for the purpose of vaccination should be within the reach of all. We have no hesitation, therefore, in recommending that steps should be taken to secure this result. Whether the duty of providing calf-lymph should be undertaken by the Local Government Boards in the several parts of the United Kingdom, or whether some other method would be more advantageous, can be better determined by those who have had practical acquaintance with the working of the vaccination laws.

446. It would, in our opinion, be an advantage if the postponement of vaccination, were expressly permitted, not only on account of the state of the child, but of its surroundings and any other conditions rendering the operation at the time undesirable. If more discretion in this respect were possessed and exercised, we think untoward results would become even rarer than they are.

If provision could be made in cases in which insanitary conditions would cause risk to a child, if it remained at home whilst the vaccination wound was unhealed, for its removal elsewhere during that period, we think it would be desirable.

447. We think that the vaccination vesicles should not be opened unless for some adequate reason. We have already said that in our opinion the importance of this has been exaggerated, but the precaution is nevertheless a wise one, and may be of use.

448. We think that safety would be increased by preserving the lymph in tubes instead of on "dry points." There is some difference of opinion on this matter amongst those with whose opinions we have been furnished. On the whole, however, we think the weight of experience as well as reason is in the direction we have indicated.

449. Another precaution which ought to be insisted on is that no instrument should be used for the operation which has not been boiled or otherwise sterilised for the purpose; and the simpler the instrument employed the better.

Care should be exercised, too, not to place the insertions too near together, so as to injure the vitality of the tissues between them.

(D)—What means, other than vaccination, can be used for diminishing the prevalence of small-pox; and how far such means could be relied on in place of vaccination.

499. We have no difficulty in answering the question, what means other than vaccination can be used for diminishing the prevalence of small-pox?—We think that a complete system of notification of the

disease, accompanied by an immediate hospital isolation of the persons attacked, together with a careful supervision, or, if possible, isolation for sixteen days of those who had been in immediate contact with them, could not but be of very high value in diminishing the prevalence of small-pox. It would be necessary, however, to bear constantly in mind as two conditions of success, first, that no considerable number of small-pox patients should ever be kept together in a hospital situate in a populous neighbourhood, and secondly, that the ambulance arrangement should be organised with scrupulous care. If these conditions were not fulfilled, the effect might be to neutralise or even do more than counteract the benefits otherwise flowing from a scheme of isolation.

503. We can see nothing then to warrant the conclusion that in this country vaccination might safely be abandoned, and replaced by a system of isolation. If such a change were made in our method of dealing with small-pox, and that which has been substituted for vaccination proved ineffectual to prevent the spread of the disease (it is not suggested that it could diminish its severity in those attacked), it is impossible to contemplate the consequences without dismay.

To avoid misunderstanding, it may be well to repeat that we are very far from underrating the value of a system of isolation. We have already dwelt upon its importance. But what it can accomplish as an auxiliary to vaccination is one thing, whether it can be relied on in its stead is quite another thing.

(E)—Whether any alterations should be made in the arrangements and proceedings for securing the performance of vaccination, and, in particular, in the provisions of the Vaccination Acts with respect to prosecutions for non-compliance with the Law.

524. After careful consideration and much study of the subject, we have arrived at the conclusion that it would conduce to increased vaccination if a scheme could be devised which would preclude the attempt (so often a vain one) to compel those who are honestly opposed to the practice to submit their children to vaccination, and, at the same time, leave the law to operate, as at present, to prevent children remaining unvaccinated owing to the neglect or indifference of the parent. When we speak of an honest opposition to the practice, we intend to confine our remarks to cases in which the objection is to the operation itself, and to exclude cases in which the objection arises merely from an indisposition to incur the trouble involved. We do not think such a scheme impossible.

Notes are added to the report showing that some of the members differ in their opinion with regard to compulsion, and two of the members make a separate statement of the grounds of their dissent from the report. E. W. W.

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SECTION I.

SANITARY SCIENCE & PREVENTIVE MEDICINE.

PAPERS AND DISCUSSIONS.

"*Small-pox and Vaccination*," *by* HENRY W. NEWTON, J.P., Chairman of the Sanitary Committee, Newcastle-upon-Tyne.

INTRODUCTION.

A PAPER on small-pox and vaccination must necessarily embrace statistics which have frequently been reviewed and circumstances which are matters of history. The former may be considered somewhat tedious, the latter unsavoury. But the recent experience of London and Gloucester affords sufficient grounds for reviving the subject, and contrasting the present attitude of the nation towards vaccination with that of 100 years ago. Moreover the question is one of such importance to the public health as to require no apology on my part for introducing it to the consideration of this meeting.

On May 14th, 1796, Dr. Jenner, then in his forty-eighth year, first performed the operation successfully, and raised the standard of triumphant science on the annihilated memories of one of the most deadly and loathsome diseases which humanity has known.

The beneficent effects of vaccination should require no advocacy. The extermination of small-pox in all cases where this preventive has been fairly applied is the universal testimony to its inestimable worth. The immunity from this disease which is now enjoyed has blinded the public to its horrors, and generated a disregard for the protecting influence which it affords.

In order to appreciate the value of vaccination and to afford some idea of the terrible conditions which Jenner laboured to ameliorate, we must glance at the prevalence of small-pox before his time.

The first reliable description of it was given by a Christian priest who associated the healing art with his sacred calling at Alexandria in the reign of the Emperor Heraclius, A.D. 610-641. From time to time during the Middle Ages this disease devastated Europe. It was considered contagious and looked upon as an unavoidable evil to which the human family must at least once, sometimes twice or even thrice submit. The fearful and fatal character of epidemic small-pox cannot be appreciated by those who have not witnessed it, but thanks to the efficacy of vaccination in our day, it is almost unknown except in the literature of disease.

It was our duty to encounter one such outbreak some twenty-five years ago, and then, as recently in Gloucester, its victims were found amongst those who, through ignorance or prejudice, refused to avail themselves of the great discovery of Jenner.

In the ninth century we find a learned man explaining why hardly any were exempt from small-pox, and why children, especially males, rarely escaped its attacks.

In 1593 Hellwaye, the author of the first systematic treatise on small-pox, says: "I need not greatly to stand on the description of this disease, for it is a thing well known unto most people."

In 1688 a person was advertised for in the London Gazette; he was the utterer of false coin and was thus described: "John Bayley, a short and burley man, fair and fresh coloured, *without poch-holes*, flat-nosed and under forty years of age, commonly weareth a fair periwig, and useth a blue as well as a red coat;" whence we see that the absence of "poch-holes" was the exception, their presence the rule.

Lord Macaulay, writing of the death of Queen Mary from small-pox in 1694, tells us of the public appreciation in which it was held at the end of the seventeenth century. He says: "That disease over which science has since achieved a succession of glorious and beneficial victories was then the most terrible of the ministers of death. The havoc of the plague had been far more rapid, but plague had visited our shores only once or twice within living memory, and the small-pox was always present, filling our churchyards with corpses, tormenting with constant fears all whom it had not yet stricken, leaving on those whose lives it spared the hideous traces of its power, turning the babe into a changeling at which the mother shuddered, and making the eyes and cheeks of the betrothed maiden objects of horror to the lover."

Horace Walpole in a letter to a friend, dated April 21st, 1758, says: "Lord Dalkeith is dead of the small-pox in three days. It is so dreadfully fatal in his family that besides several uncles and aunts, his eldest boy died of it last year, and his only brother who was ill but two days putrefied so fast that his limbs fell off as they lifted his body into the coffin."

Servants, male and female, who had passed through the small-pox were at a premium, and were advertised for much in the same way as dogs now are that have got over the distemper. In October, 1774, the following requirement was publicly made: "Wanted a man between twenty and thirty years of age to be a footman and under-butler in a great family. He must be of the Church of England and *have had the small-pox*."

An eminent writer, Thebasius, said: "No nation, no rank, no constitution, neither age nor sex escaped small-pox; all trembled in mentioning its name."

In 1794 Dr. Buchan wrote that the disease was so generally known that a minute description was unnecessary.

A literary lady, writing of the appearance of her friends early in the century, says that nearly everyone was more or less poch-pitted.

Those who survived the disease were terribly disfigured. The face was deeply pitted, and it was no uncommon spectacle to encounter persons distorted and blind from its ravages. These unfortunates are not so common as they were some years ago, as some here will remember, but even now we occasionally meet persons who suffered from "the natural Poch" in the early part of the century, when vaccination was difficult and not generally accepted. A sad illustration of this class of victim may daily be seen in the principal thoroughfares of Newcastle; he contracted the disease sixty years ago in Ireland. Before the time of Jenner the ravages of small-pox in Europe were terrible. One eminent authority estimated that it destroyed, maimed, or disfigured a fourth part of the human family. A second authority estimated the amount of deaths at 210,000, a third at 400,000, while Bohn believed that half a million fell victims to this plague.

De la Condumaine calculated that it was responsible for one tenth of the deaths in France. A Dauphin of France died of it in 1711, and Louis XV., who had passed safely through the disease when he was fourteen years old, succumbed to it in 1774 in the sixty-fourth year of his age. Carlyle refers to the king's last moments in the following terms:—"The Louis that was lies forsaken, a mass of abhorred clay, abandoned to some poor persons and priests of the Chapelle Ardente who make haste to put him into two lead coffins, pouring in abundant spirits of wine."

With regard to Germany, Casper states that before vaccination was introduced into Berlin, one in twelve of the children died of small-pox.

In Russia, one death out of every seven was due to this disease. In 1691 that country was visited by a terrible epidemic which destroyed the entire population of several towns. In 1856 100,000 died of it. After giving these figures, I need hardly say that vaccination in Russia was not compulsory, and only adopted by the wealthy and educated classes.

In England small-pox first came into prominence during the reign of James I., and it grew more painfully familiar in the course of the 17th century, when small-pox was described as becoming more pernicious than the great plague. It was estimated that during the last thirty years of the 18th century 70 out of every 1,000 deaths which occurred were due to it. In the year 1800 this disease was brought to our shores twenty times by the Channel Fleet alone. It entered the palace as well as the cot. William III. lost both his parents thereby, and his own constitution was in early life enfeebled by the same cause. Queen Mary, as Macaulay tells us, died of small-pox, which also proved fatal to her uncle the Duke of Gloucester in 1660.

The House of Hapsburg suffered severely. Joseph I. fell a victim to it at the age of 33, and in the course of the eighteenth century this disease killed two Emperors, six Archdukes and Archduchesses, an Elector of Saxony, and the last Elector of Bavaria.

Prescott, the historian, referring to the introduction of small-pox into Mexico, says:—"It swept over the land like fire over the prairie, smiting down prince and peasant, leaving its path strewn with the bodies of the natives who perished in heaps like cattle stricken with the murrain." Often there were none left to bury the dead. In 1563 whole races were destroyed, and at the same time in the province of Quito 100,000 natives fell a prey to its virulence.

The same thing has been noticed both in North and South America; whole tribes have been swept away, and flourishing industries—mining for example—arrested for years.

INOCULATION.

Many attempts have been made to stop the progress of the devastating scourge, the most approved being inoculation, or the introduction of the virus of small-pox into the healthy body, through which it should circulate and develop the phenomena of the disease, as was believed, in a modified form. This practice is of great antiquity, and was of widespread acceptance. There are allusions to it in the ancient literature of China, India and Arabia. In China the small-pox was sown by powdering the dried crust from a convalescent and blowing it into the nostrils—a mode of operation which has been in use for at least ten centuries. The process was usually performed on an auspicious day in order that the best results might be secured.

Inoculation, while mitigating the virulence of the disease, possessed the certainty of diffusing the danger which it was intended to relieve and of creating a fresh source of contagion in every patient who submitted to it.

In 1772 the Princess of Wales and her two daughters availed themselves of the treatment, which soon came into general use.

In 1774 the Royal College of Physicians formerly accepted inoculation, and in the same year two scions of royalty were operated on. Improved knowledge which came from experience lessened the danger.

One operator, Daniel Sutton, and his assistants are said to have inoculated 20,000 persons without a single death that could fairly be attributed to the operation.

Dimsdale was in 1768 summoned to Russia to inoculate the Empress Catherine and her son, receiving for his services a fee of £10,000 and an annuity of £500, with a title which is still held by his descendant.

While the inoculation sheltered the wealthy classes who alone could avail themselves of its protection, it spread the germs of the disease broadcast and secured its lasting presence.

It was a formidable operation, very different from vaccination. For four weeks previous to the performance severe preparatory treatment was necessary, and medical supervision for six successive weeks was required afterwards. Jenner had a painful recollection of the discipline which he passed through. "There was," he said, "bleeding till the blood was thin, purging till the body was wasted to a skeleton, and starving on vegetable diet to keep it so."

We can easily understand that a practice so tedious, costly, and perilous would never become general. Forty-four years after the discovery of vaccination, namely in 1840, inoculation was prohibited by Act of Parliament.

VACCINATION.

Vaccination was practised before the time of Jenner, but the world is indebted to him for demonstrating its efficacy. He was a close observer, and he noticed that while small-pox visited all classes equally, it passed without molestation dairy-maids and others employed in milking, who suffered from sore hands. This freedom from infection was entertained as a legend in the pastoral districts until Jenner rescued it from the dark recesses of rural tradition, endowed it with form and life, and rendered it a valuable servitor to humanity.

It is needless to enter into any details of the mode in which the discovery was made or to describe the labours of Jenner in urging a reluctant people to accept this inestimable boon. Scope for only a few facts is possible, and these must be condensed. In London a very striking decrease in the number of deaths from small-pox was noticed as the result of vaccination. From 1 in 10 the death-rate fell in twenty years to 1 in 28, or little more than a third of the former proportion. In fact, wherever vaccination has been introduced we find a diminution of small-pox, and this diminution is governed by the extent to which vaccination is adopted. It extinguishes the disease as surely as the sunshine disperses the shades of night.

The mean death-rate of Sweden for the twenty-eight years preceding 1801 was 2,045. During the next fifteen years, *i.e.*, from 1802 to 1816, with permissive vaccination, the death-rate fell to 480. Then during seventy years of compulsory vaccination it fell to 155. This number has been further reduced within the last decade, and now small-pox is practically extinct.

In Norway, a local paper assures us, no unvaccinated person is allowed to vote for a member of Parliament—obviously a case of politics *versus* hygiene. Were such a law ever passed in this country, what a difference there would be in the plebiscite!

In Germany vaccination was encouraged but not enforced by the state until 1874, when all babies were required to be vaccinated, and school children to be re-vaccinated. The result is that in Prussia the death-rate from small-pox is only seven per million.

In Austria during the thirty-five years from 1847 to 1882 the mean death-rate was 580.

In England at the beginning of the century the mean death-rate was over 2,000. During twelve years of permissive vaccination from 1838 to 1853 it was 417, in the next eighteen years it fell to 154, and after 1871 when vaccination had been made compulsory it fell to 53, and for the last ten years it has been 24.

Wherever vaccination is adopted, small-pox is excluded, as is illustrated in the case of Germany and Austria. In the former where vaccination and re-vaccination are enforced, small-pox is almost unknown, while the latter, under similar general conditions, furnishes a high death-rate, and is a source of peril from contagion to its neighbours.

In Spain there are no vaccination laws in force. During the year 1889 there died from small-pox in the province of Almeria 3,080 per million, in Murcia 2,070, in Cordova 1,400, in Malaga 1,340, in Cadiz 1,330. For the same year the death-rate in protected Germany was four per million.

It is remarkable that when an outbreak of small-pox occurs in a district or household, those individuals who are protected by efficient vaccination are passed over, and the disease selects for its victims, the unvaccinated or those who have submitted to a *pro forma* operation, in observance of the letter but not the spirit of the law. Many such instances occurred recently at Gloucester, *e.g.*, in one family of seven, two who were protected escaped, while the other members were attacked. In two epidemics in which I have worked this was very noticeable. The unvaccinated are, as by an unvarying law of nature, the first and chief sufferers.

General observation and personal experience prove the value of efficient vaccination, by which must be understood the presence of four distinct cicatrices. An officer of the Local Government Board informed me that he had never seen small-pox where the four marks existed.

During the two visitations of small-pox in Newcastle I had the management of an hospital for the reception of persons who had passed through the acute stage (and were casting the scales), until desquamation was complete and the danger of contagion past. There was not a special small-pox hospital at the period to which I refer, nor was the municipality responsible for the public health. The patients under my charge were at the stage of the disease when they were most dangerous to others. The hospital was saturated with contagion, and every cubic inch of atmosphere freighted with the pestilential germs sufficient at each inhalation to generate an epidemic. The nurses, attendants, and medical officers performed their duties, living and breathing in this hot-bed of disease with the utmost immunity. The power to pass scathless through the infected corridors and wards with a protection like unto that of the three Israelities in the fiery furnace was due to the heaven-born work of Jenner. For every person prior to entering upon his or her dangerous duties was re-vaccinated, the medical officer (myself), of course, included.

In Gloucester, the capital of Jenner's native county, to-day an object lesson is presented to us. In that city vaccination has, for some years, been disregarded, until it has become the exception rather than the rule. 84·7 of the population were unvaccinated, and they rejoiced in their ignorance, believing that vaccination was unnecessary and small-pox a delusion. They experienced a terrible awakening in the spring of this year, and before the end of May 1,822 persons were attacked, and 396 died, the proportion of deaths being 21·7. The epidemic is now exhausted, its force has been broken by a general vaccination and re-vaccination of the inhabitants who were eager for this protection when they became cognisant of the terrible plague in their midst.

To our discredit as a nation, the year which witnesses the centenary of Jenner's discovery finds his memory discredited in the county in which he was born, and as a consequence the city of Gloucester suffering from a severe epidemic of small-pox, while far-away Japan honours his genius, and determines to erect a statue in his memory, as a recognition of the immense value which his discovery has proved to the Japanese nation. The Emperor and Empress are foremost in this movement. Verily a prophet hath little honour in his own country! The contrast between plague-stricken Gloucester and healthy Tokio, is enough to humiliate us as Englishmen.

The May number of "The Practitioner" is a "vaccination number" in honour of the Jenner centenary, and the editor has a good deal to say that is peculiarly interesting in view of the recent small-pox outbreak at Gloucester. "After all," says "The Practitioner," "the best memorial to Jenner is the fact that the name of small-pox, which used to bulk so large in the old Bills of Mortality, has been almost blotted out of the Registrar-General's reports. Were it not for the perverse folly of a small but noisy band of faddists, the disease would be as extinct in this country as the plague.

Vaccination is a simple process, causing little constitutional disturbance, and is practically free from danger. The greatest care is exercised in its performance. The vaccinifer is selected after a scrupulous examination, aided by the special knowledge which experience has supplied. The lancet is cleaned after every operation, and a record preserved of the source from which the lymph is taken in each case. With such precautions, vaccination is an innocent measure, which promises a great result.

After thirty-three years' experience as a public vaccinator, during which I have treated 50,000 cases, I can speak with some authority. I have demonstrated the faith that is in me by performing the operation upon my children and myself, indeed, I have been vaccinated three times.

The tendency of parents to refer to vaccination every disease, especially those of a cutaneous character, which the child may afterwards develope, is very general. Most of the allegations are without proof or probability, mere illustrations of "post hoc, propter hoc." It is possible that vaccination, like teething, may hasten the evolution of a constitutional disease which has been incubating. But isolated instances of this kind have no relation to the great question of vaccination which has given to mankind the mastery over one of the worst diseases which history has recorded. Our observance of the laws of nature has enabled us to deal with plague, cholera, and typhus, which consequently seldom visit our shores, while our neglect for the laws which govern small-pox (a distinctly preventible disease), cause it to be ever present with us.

[*For discussion on this paper see page* 382.]

"*Small-pox, and the Means and Difficulties of its Prevention,*" *by* J. C. GRIFFITH, Chairman Public Health Committee, Cheltenham.

ABSTRACT.

CHELTENHAM, a town of 50,000 inhabitants, originally a famous inland watering place, has now become a great centre of education and a residential town.

The corporation is actuated by a progressive spirit to maintain its character as a health resort, and to attract residents by every means in its power, and especially by the adoption of the most advanced principles of sanitation. Hospitals exist for the isolation of all the principal infectious diseases.

The outbreak of small-pox in the neighbouring city of Gloucester seriously threatened the prosperity of Cheltenham. Constant communication existed between the two towns, and there seemed every probability of its being introduced.

Unhappily of late years the Board of Guardians had refused to enforce the vaccination laws, and it was found that there were no less than 3,150 children, under 14 years of age, unvaccinated. The Corporation at once erected an additional small-pox hospital and prepared foundations and drainage for a series of double hospital marquee tents.

They pressed upon the Guardians their duty to afford increased facilities for vaccination, but without avail, for the Local Government Board would only sanction the attendance of the public vaccinator twice in each week instead of once.

The Corporation then organized a scheme of gratuitous and general vaccination and re-vaccination with calf lymph, and made arrangements with twenty-four medical men to vaccinate at a fee of 2s. 6d. per case, all who might apply to them. Thus 9,200 vaccinations were performed.

Such action on the part of a health authority is however, unauthorised, and objection might be made to its expense, either by the Local Government Board or any ratepayer. So

the sanction of the Local Government Board was sought. They refused, since the duty was one rightly appertaining to the Board of Guardians. Invoking, however, the intervention of Mr. Chaplin and Mr. W. Russell, the Local Government Board consented to sanction the appointment of these twenty-four gentlemen as Deputy Public Vaccinators, and to the total expense some £1,150 being charged upon the Common Fund of the Union.

All public gatherings, athletic sports, hunt races, etc., were postponed, to prevent the assembling of large gatherings, and the attendance of people from Gloucester.

The Medical Officer of Health was most active in the isolation of those cases of small-pox which did occur, and in watching and keeping in strict quarantine all persons who had been exposed to infection; consequently, with the exception of 24 cases which were all treated in the hospital, Cheltenham altogether escaped the epidemic. Not a single death occurred.

My experience proves that general and gratuitous vaccination, and the provision of adequate accommodation for isolation in anticipation of an outbreak, is the only safe method which a town can adopt when threatened by an epidemic of small-pox; that Boards of Guardians or other popularly elected bodies are not fitted to be entrusted with the administration of the Vaccination Acts; and that the right official to do so is the one now primarily charged with the issue of the Vaccination Certificate to the parents of the child, the Registrar of Births and Deaths for the district.

A recommendation from the Congress in this direction cannot fail to be appreciated by the Government when they come to frame legislation based upon the report of the Vaccination Commission.

[*This discussion applies to the papers by* Dr. H. W. NEW[illegible]ON *and* Mr. J. C. GRIFFITH.]

The PRESIDENT of the Section (Prof. Corfield) said he wonder if it ever occurred to them what the reason was that the portra[illegible]its the great Court beauties of former centuries were not, in the ma[illegible] of instances, the portraits of beautiful women. The reason [illegible] simple. Every woman in this country who was not marked small-pox was a beauty. That was so. It was perfectly ce[illegible] that was the reason. The other remark he had to make w[illegible] personal one, and that was that Mr. Griffith's paper had given as an old Cheltenham man, the greatest possible pleasure as showing the admirable way in which Cheltenham coped with a serious difficulty.

Surgeon-Major HUTTON (Leamington) said he had served for a great many years in the Army, and during that time they paid strict attention to vaccination and re-vaccination. While in the town of Dover small-pox prevailed in the neighbourhood, their strength at that time being between five and six hundred. The Franco-German war broke out, and they were ordered to recruit the Battalion of the Rifle Brigade in which he was serving up to the full strength, so that in a few weeks they jumped up to about 951. These recruits came from the poorer districts, but as soon as they came they were re-vaccinated, and although small-pox was prevailing in Dover at the time, no case occurred in the battalion. With reference to what Lord Percy had said that morning he (Surgeon-Major Hutton) hoped that great care would be taken in all future legislation with regard to this most important subject. He might say that he himself did not altogether agree with the penal clauses.

Brigade-Surgeon Lieut.-Colonel R. PRINGLE (Blackheath) said he was sure they had listened with great interest to the two most important papers just read. One showing what small-pox was, and had been, and the other what it might have been at Cheltenham only this year, but for the most systematic and careful preventive measures which had been so successfully carried out. Indeed, in those two papers lay the whole question before them. As one who, he might say without exaggeration, had given a life service to this great question: he would only add that he was a greater believer in vaccination than Jenner could possibly have been, for he was sure Jenner could never have seen what he had seen—troops moving about with impunity in the midst of small-pox, where frequently the people, adults and children, were covered with it, and not the least attempt at isolation. They were in no state of alarm there. They were successfully vaccinated, and had faith in the prophylactic. He had closely studied a system of inoculation carried out with varying success in the Himalayas, and had gone the length of putting vaccination against inoculation in adjoining villages, and had seen the successful results of the former. Above all, he had had the satisfaction of persuading those believing in and practising inoculation with remarkable success to give it up, and accept vaccination, indeed, of persuading many hereditary-priest inoculators to become Government Vaccinators. During his thirty years Indian service, he had seen leprosy in its home in Sirri Ghurwal in the Himalayas, also bubonic plague in British Ghurwal in the Himalayas; he had seen cholera claim its victims by hundreds, but, of all the awful epidemic diseases to witness, preserve him from an outbreak of small-pox unchecked by inoculation or vaccination. Instead of sitting in London looking up old records of what small-pox was 100 years ago, he only wished the Royal Commission on vaccination had gone out to India, and instead of looking at records and figures (valueless from necessarily

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Mr. William Logan (Langley Park) said he had been a Poor Law Guardian for twenty years, and his experience was this—that instead of the Commission sitting to relax the laws of vaccination it ought to have sat to strengthen them, and to take away the power from any Board of Guardians to say whether they should be carried out or not. When they elected a popular body and gave them a permissive power, they would find that there were a number of people who would go contrary to common sense, simply because they got the permission. In his own union, which comprised a population of nearly seventy thousand people, they had always carried out the law strictly and impartially. In the last twenty years they had only had one very slight epidemic of small-pox, and that did not originate in the district; it was imported. As to making the Registrar of Births and Deaths the official to carry out these prosecutions he did not think, if the Board of Guardians were not an efficient body, that that official would be an efficient person, because he was appointed by the Board of Guardians.

Dr. Park (Houghton-le-Spring) said that as a public vaccinator he was compelled to put on four marks, and those marks must be of a certain size, whilst others in the town and immediate neighbourhood could satisfy the requirements of the Act by putting only one mark on. He thought that had a very serious effect, and the Local Government Board should see that it was altered.

Mr. John S. Brodie (Whitehaven) thought in their various capacities as Poor Law Guardians, Members of Councils, and so on, they might personally educate their constituents in regard to vaccination. Some people had certainly an idea that this vaccination was a very terrible thing. He had himself been vaccinated and re-vaccinated twice, not because he had been afraid of small-pox, but on principle. He thought there should be less fear and prejudice against the principle of vaccination.

Miss Williams, M.D. (Newcastle-upon-Tyne), said she had been reminded of two classes of circumstances under which she had been called upon to grapple with the beginnings of small-pox epidemics. Neither of these classes had been touched upon during the discussion, and she thought perhaps it might be a matter of interest to mention them. The first class of case originated in a country workhouse among the casuals. When she was first qualified it was her fate to see that case drag itself through three or four country workhouses. The second class, which she had come across lately, were the dangers which arose from the large shelters which one found so common in East and South London. She had been working lately in the neighbourhood of one of those shelters which had produced two small epidemics, and on one occasion kept them busy with quite a serious epidemic. She would like to say one word on another point which had occurred to her, and that was as to a case of so called insusceptibility to vaccination. She had had a great many cases of adults brought her, mostly people who wanted to enter some situation in which they were required to be vaccinated, who had avowed and declared that they had been vaccinated and re-vaccinated by most competent authorities. Yet she had never found a single case which was insusceptible, and she did not believe such cases could exist.

Mr. P. B. **Stoney** (Millom) was in hope that in a meeting like that, remarks would be made which would help future legislation in regard to public vaccination. His own feeling on the subject was—and he had been a public vaccinator for two or three and twenty years—that a great feeling against vaccination was often engendered by practitioners who felt that their work was taken away from them by the public vaccinator. He saw a report a little while ago from a Medical Officer of Health which suggested that all medical men should be public vaccinators and that Medical Officers of Health should inspect the cases. That would do away with the feeling which was engendered in many medical men's minds. He himself believed that some medical men in a district only vaccinated in one or two places. He held the strong opinion that if all medical men were appointed public vaccinators and paid by the State, that feeling would be done away with. Vaccination would be compelled to be efficient, and he did think that on those lines they would do away with a great deal of the feeling which was engendered by public vaccination as it now existed.

Mr. **Hilton** (Barnard Castle) said that as a Guardian he had taken rather an active interest in what might almost be called anti-vaccination. Not altogether so; but he had a strong opinion that compulsory vaccination was not the thing they ought to have provided when the community at large might suffer by it. His reason was partly grounded on this: A young girl, graduating as a school teacher, was sent to Durham. Her parents were poor people, and he had induced them to go into a building society, and they had got £20 scraped together. This poor girl after being vaccinated, became a total wreck, and the £20 went. The authorities had been very good, and they had put her into as good a situation as they could. Another Guardian had told him of a case where at least one child died before the effects of the operation were fairly gone, and he attributed the death of the child to the operation. Would they send those parents to gaol if they would not have any more vaccinated? He would like, if possible, to elicit something which would partly guide one's conduct hereafter.

Sir **Charles Cameron** (Dublin) said he would like to say a few words with regard to what vaccination had done for the country that he came from. The country he came from was one which was noted for being a law abiding one. He was sorry to say that in many parts of England they did not respect the laws. Whole communities, having a perfect organization, had set the laws of this great Empire at defiance and snapped their fingers at them. The laws in relation to vaccination had been defied in England, whilst they had been strictly observed in Ireland. No one had ever objected to the Vaccination Laws in Ireland. There had been implicit obedience paid to them. In Ireland also vaccination was very early carried out, and with excellent results. There was no question in the world that if England had suffered severely from small-pox in the last century and the beginning of the present one, Ireland suffered still more. In the towns of Ireland there was much poverty and much overcrowding, and all the factors that were essential to wide-spread diseases of that kind were present, and therefore in Ireland small-pox was an extremely common disease. Indeed, he remembered in his own early days, in the *beginning* of the century, he often noticed people with marks of small-pox. It was impossible when he was a little boy to walk from one end of the street to the other in Dublin without meeting at least one, and perhaps half-a-dozen persons bearing on their faces the marks of that fell disease. Now, of course, they knew that small-pox was not such a disease as it was once. It did not as a rule produce the terrible marks upon the faces of its victims that it did in those early days. The disease itself appeared to have undergone some kind of modification. He thought that it was largely due to the fact that there was perhaps not a single person in the United Kingdom some of whose ancestors had not been vaccinated. Although he was a believer in re-vaccination he believed that the people of these countries now, whether vaccinated or not, enjoyed a certain amount of protection from the fact that their ancestors had been vaccinated and re-vaccinated. There was perhaps no other way to account for the fact that the disease was now so much milder as compared with former times when small-pox was so prevalent. When vaccination was first introduced it was very widely spread throughout the whole country. In rural districts in Ireland inoculation was general and they were quite prepared, therefore, for a substitute for inoculation. He had made a special inquiry into the history of vaccination in Ireland some years ago and was quite satisfied that vaccination early in the century became very general in that country, but the effects were not so widely felt as the effects of vaccination were in the present day. In Ireland, under the influence of vaccination—vaccination continued through many generations—the disease for many years until quite recently, was completely absent. For many years Ireland was in the position of being able to say that she had not a single case of small-pox in the country. Unfortunately, in Dublin, after a very long interval of time, an epidemic, due to the introduction of the disease from England, occurred the year before last. The disease did not assume very large proportions, and it had now completely died out, but during the progress of that disease never was the influence of vaccination more strikingly shown. It was so incontrovertable that no one for a moment thought of questioning the value of vaccination in Dublin. In the epidemic which occurred there he thought there was scarcely a single case amongst persons who had been re-vaccinated. None of the nurses, none of the doctors, none of the medical students—except the case of a medical student who had not been re-vaccinated—were affected during the epidemic. Therefore he thought in Ireland at all events, the influence of vaccination had been very clearly established. He would like to touch upon one other point: the negligence of some persons in regard to vaccination. In Ireland, as previously mentioned, they were a very law-abiding class of people; they did not disobey the law willingly, but they sometimes did it from mere carelessness. All persons in Ireland believe in vaccination, but from carelessness of one kind or another, they did not always get their children vaccinated. That was the case in Dublin. The Sanitary Authority in Dublin was not responsible for the carrying out of vaccination, that was a responsibility that devolves on the guardians, and the guardians did not do their duty in enforcing vaccination, or rather in finding out where the children were who had not been vaccinated. One cause of that was that the relieving officers whose duty it was to ascertain where the children were who had not been vaccinated, but whose births had been registered, neglected to do their duty because they got a fixed salary. When people got a fixed salary there was naturally a tendency to do a minimum amount of work for it. He suggested therefore, payment by results. Pay the relieving officers sixpence for every child whom they discovered had not been vaccinated. A great difference was seen at once. There was a search through every corner of Dublin and the result was that thousands were brought up. He was able to collect some statistics, and found that about 40,000 people in Dublin were vaccinated or re-vaccinated, but during the whole period of that epidemic, and during the terrific scramble to get vaccinated there was not a single person known of—not one—who questioned the efficacy of vaccination.

The Mayor of Coventry said he thought it might strengthen the hands of the Commissioners when the subject came before the House of Commons for discussion if a resolution was passed from this meeting. He thought that there was a great unanimity of feeling that the time had gone by for the power to be retained in the hands of the Board of Guardians for the carrying out of the Vaccination Act. He thought that was a strong feeling that had permeated the whole country. He spoke from an experience of twenty-five years as a Guardian, and was sure it would never be carried out as it ought to be unless it was taken out of their hands and placed under a different authority. If a resolution was passed to that effect it would be of great benefit.

The President of the Section (Professor Corfield) said a resolution of that kind could not be passed by the Section without due notice had been given, and without its being printed in the Daily Journal of the Congress.

On "*The Spread of Enteric Fever by means of Sewage Contaminated Shell-Fish*," *by* ARTHUR NEWSHOLME, M.D., Lond. M.R.C.P.

(FELLOW.)

SOME months ago an intelligent clergyman expressed surprise that with so many doctors there was any disease left. I made the obvious retort that it was even more surprising that with so many clergymen, sinners still abounded. The two cases are of course only comparable in so far as sin and disease are both caused by aberrations from the path of duty over which the individual or the community could exercise control. But the clergyman's remark is interesting, as illustrative of the lack of appreciation by even the educated public of the difficulties connected with the prevention of disease. Even given a known cause, how long before its practical removal is attempted, as witness the present almost complete lack of supervision in this country over the distribution and consumption of milk from tubercular cows. But in too many instances, our knowledge of the causation of diseases is still most imperfect; and then our preventive measures must necessarily be empirical and uncertain.

Take such a disease as enteric fever. It is certain that this is caused by the inhalation or probably oftenest by the swallowing of a specific micro-organism. That this is most commonly conveyed by means of milk or water which has become specifically contaminated is well known. That the effluvia from defective drains sometimes cause it, appears highly probable; though I doubt whether having regard to the consideration that defective drains are extremely common, and cases of enteric fever comparatively rare, it would be possible to satisfy the searcher after truth with a strongly logical mind, that the relationship of cause and effect between bad drains and cases of enteric fever had been clearly established in any given cases.

When an outbreak of enteric fever comprising a considerable number of cases within a short time is being investigated, it is usually comparatively easy to discover the facts common to all. When, however, single cases are being investigated, the task is more difficult, and one has frequently to be contented with a lower degree of probability as to causation. I may perhaps be allowed to instance my own case.

On Dec. 31st, 1895, I came home with headache and general malaise. Next morning I found that my temperature was over 102°, and I then passed through a well-marked attack of enteric fever followed by a relapse. How had this been acquired? I

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in actual life we can only indicate this cause in a given case, with a varying degree of probability. To use the definition of "cause" given by Jevons, by the cause of an event "we mean the circumstances which must have preceded it in order that the event should happen."

The essential cause of enteric fever is the specific bacillus of the disease. The secondary causes are the vehicles, be they water, milk, or shell-fish or other, along with which this bacillus is mechanically ingested. This does not complete the definition of the cause of enteric fever. Something more is required. Of those drinking milk contaminated with enteric stools, on the average probably only 10 or 12 per cent. develope the disease. This might be explained on the supposition of accidental failure of the seed to take root. There are certain persons, however, in whom enteric fever (apart from accidental failure) *will not* develope, and we must therefore assume a share in the individual in the causation of enteric fever for certain favouring conditions of the system, resulting from inherited or acquired weakness.

The bearing of these preliminary remarks will be more evident when I have detailed the special circumstances that gave rise to the investigation the results of which I now give. Brighton has a well-earned reputation for freedom from preventible diseases, especially a disease like enteric fever, which is commonly associated with insanitary conditions. That an immense reduction has already been produced is evident from the following table. The same table shews the favourable position occupied by Brighton as compared with that of the metropolis.

Death-rate from "Fever" per 100,000 Inhabitants.

Year.	Brighton.	London.
1869	38·0	53·1
1870	39·6	48·0
1871	37·6	40·0
1872	27·1	33·9
1873	33·1	36·5
1874	33·5	35·4
1875	25·7	31·3
1876	14·1	26·4
1877	17·9	30·5
1878	15·6	33·7
1879	9·6	27·2
1880	20·7	22·1
1881	41·7	28·9
1882	24·9	27·6
1883	24·6	27·3
1884	14·5	25·4
1885	16·2	17·0
1886	11·5	17·2
1887	11·6	16·2
1888	13·2	17·8
1889	15·8	14·0
1890	11·3	15·5
1891	11·2	14·2
1892	6·9	10·7
1893	12·7	16·6
1894	9·0	14·9
1895	11·7	1·40

The table, however, while it indicates a very favourable state of matters when viewed from a comparative standpoint, shews that during the last ten years the rate of reduction in the fever death-rate has not been so rapid as previously. This is doubtless in part because there is less scope for improvement than in the past.

It suggests, in addition, the view that the insanitary conditions to which enteric fever in the past was largely due, have been in a large measure removed, while some cause apart from these must be invoked to account for a large share of the comparatively small amount of enteric fever still remaining.

My attention was first drawn, early in 1894, to the possibility of uncooked sewage-contaminated shell-fish being a local cause of enteric fever by three cases, which I will now briefly narrate.

1. On March 4th, 1894, a fishmonger's errand boy, aged 13 years, began with enteric fever. There were in the same house five children under 10 years of age and three adults, who all, including the father and mother remained well. About seventeen days before the onset of his illness, the boy remembers that the foreman of the shop gave him three oysters. The drainage of this house was perfect. No other cases of enteric fever in connection with the same milk supply. No other members of this household took oysters.
2. On March 14th, 1894, a girl aged 13 years, began with enteric fever. She and her mother ate oysters frequently before the onset of illness. The mother had an attack of diarrhœa at time of onset of her child's fever, but did not keep to her bed. Drainage of this house was fairly good, and did not pass under the house. No other cases of enteric fever in connection with the same milk supply.
3. On March 17th, 1894, a man, aged 37, an invalid attendant, began with enteric fever. On February 28th he bought fifteen oysters from a barrow in the street. His wife declined to join in eating these. The man ate them all himself. The wife and one other adult living in the house have remained quite well. The drainage of this house was bad. The wife had lived in this house alone, her husband living at Havant until the day on which he had the oysters.

The first two of these cases are typical of a large number of others in which—(*a*) The only person eating the oysters was the only person acquiring enteric fever; or (*b*), other persons taking oysters had illness which stopped short of a typical attack of enteric fever; while in both (*a*) and (*b*) no other ascribable cause of enteric fever was detected. The third case is typical of others in which (*c*), defective house drainage was found, in addition to the history of having eaten oysters within the period of incubation of enteric fever.

A fourth group of cases may be made (*d*), in which only one person out of many eating oysters acquired enteric fever.

I propose to give illustrative cases belonging to each of these groups, as it appears to me that the strength of the evidence connecting shell-fish with enteric fever can only be realised by a narration of such cases. Circumstantial facts which may from a mathematical standpoint be extremely weak, become strong when each link in the chain of evidence is visible.

GROUP *A*.

4. A labourer, aged 37 years, began to be ill with enteric fever on August 3rd, 1894. Three weeks before this he bought fifty oysters and took them home, where they were eaten by himself and wife. Both had enteric fever. Drainage perfect. No cause for suspecting the milk.

5. Mrs. E——, wife of a fishmonger, was confined of her first child on September 19th, 1894. On November 9th she failed with enteric fever, having taken oysters on seven or eight occasions about three weeks before this date. Drainage of house good. No other cases of illness in house. No other cases in connection with same milk supply.

6. Alice W., aged 32, a cook, in the habit of frequently eating oysters. The oysters were ordered in the name of the mistress of the house, who subsequently had a bill for a large amount for oysters, &c. Sanitary condition of house perfect. Five other adults live in the same house. None had oysters. All remained well.

7. P. C. B., aged 36 years, began with enteric fever on January 10th, 1896. On the 24th and 26th December he had given to him and ate oysters at two shops. Drainage of house good. One other adult in same house, who has remained well.

MUSSEL CASE.

8. P., aged 20, a drayman, began with enteric fever on February 3rd, 1895. Was in the habit of purchasing mussels twice a week. These he ate raw. He died of enteric fever, Four other adults in the same house, no illness, good drains.

GROUP *B*.

9. S., aged 27, a journeyman printer, died of enteric fever, which began August 4th, 1895. For a month before his illness had been working overtime, and frequently eating oysters from a barrow. The brother-in-law of this patient, who took oysters at the same times as the above patient, had attacks of diarrhœa and abdominal pain on several occasions during the two months preceding and accompanying S.'s attack. Sanitary condition of house good. Wife and lodger in same house remained well.

10. Mr. G., aged 30, a commercial traveller. Onset of illness August 27th, 1895. Very fond of oysters. On August 3rd he had eight oysters. Mr. C., who accompanied him, had an equal number and had a violent attack of diarrhœa a week later. Drainage of house good. Four other adults and two children live in the same house, all well.

11. Mr. and Mrs. M., had oysters on September 5th, and within twenty-four hours both had pains, sickness and diarrhœa. Mrs. M., subsequently remained well. Mr. M. began with enteric fever on September 13th, 1895. House drainage good. Four other persons in the house remained well.

12. Mr. C., a commercial traveller, had oysters with a boy named B., fourteen days before onset of enteric fever, on September 22nd, 1895. B. had an attack of diarrhœa, but did not take to his bed. Drainage good. Two adults and three children in the house remained well.

GROUP *C*.

13. On April 13th, 1896, George M., aged 25 years, began with enteric fever. On April 3rd, his sweetheart brought him four oysters. At the time he ate these he was recovering from influenza. The sanitary arrangements of this house were defective. Five other adults and one child living in this house remained well.

14. D. G., aged 33 years, began with enteric fever on February 26th, 1894. Since the previous Christmas he had frequent sore throats, for which he took oysters frequently. The drainage of the house was very defective. The other occupants of the house (servants) were quite well. No milk infection.

MUSSEL CASES.

15. E. B., aged 33 years, a commercial traveller, began with enteric fever on the 11th April, 1894. For six months he had frequently, including one occasion a fortnight before the onset of his illness, eaten raw mussels. The drainage of the house was defective. The seven other persons living in this house did not eat mussels. None of them had been ill.

16. Mrs. R., aged 40, a charwoman, began to be ill with enteric fever, on September 6th, 1895, and her lodger, G. E., aged 20 years, on September 4th. Each ate six large mussels about three weeks previously. These were gathered by G. E., in the bed of a river below the point where the sewage of a town enters the river. No one else in the house ate mussels. The drainage was defective. No other cases of illness among the four other adults and one child in the house.

GROUP *D*.

17. A man aged 18, carpenter, started with enteric fever on April 4th, 1896. Fourteen days earlier, he and his father and three sisters bought and ate some raw mussels. The father had an attack of diarrhœa, at the date of onset of his son's illness, the diarrhœa lasting for three days. The three sisters remained well. Drainage good.

18. On April 26th, D., aged 25 years, began with enteric fever. Since April 5th, took oysters every evening up to the onset of his illness. Two other persons in the house ate a very few oysters from the same source when the patient could not eat his usual allowance and have remained well. The above patient suffers from phthisis, and was ordered the oysters on that account.

19. Dr. —, aged 58 years, physician to a Metropolitan Hospital, arrived in the town on January 4th, 1896, from London. On the 5th, he was present at a dinner party with about nine other persons. At this dinner he ate six oysters. He subsequently complained that one of the oysters had a disagreeable taste. He began to be ill on Jan. 15th, with enteric fever. The sanitary condition of his own house in London, and of the house in which he stayed in the town, is perfect. Of the other members of the dinner party, all remained well except a gentleman aged 63 years, who had what is described as "intestinal catarrh" a few weeks (apparently about a month) after the party.

It would be quite easy to multiply instances; but those already given will suffice to indicate the groups of cases in which there was the strongest reason to conclude that shell-fish contaminated with sewage had caused enteric fever. Before giving the further evidence in confirmation of this view, I append the following statistical tables.

Cases of Enteric Fever notified since July 1st, 1893.

Year.	Number of Cases subsequently found not to be Enteric Fever.	No. of Cases of Enteric Fever the infection of which was imported from other Districts.	No. of Cases apparently originating in the town, in which—				Total Cases of Local Origin.
			(*a*). It was stated that no oysters or other shell-fish had been eaten.	(*b*). It was doubtful as to whether shell-fish had been eaten.	(*c*). Origin was directly ascribable to Oysters.	(*d*). Origin was directly ascribable to other shell-fish.	
1893 (From Midsummer)	1	16	19	6	6*	...	31
1894	15	15†	33	1	16	5*	55
1895	12	19	37	...	7‡	12§	56
1896 (Up to Aug. 4th)	8‖	7†	26	3	7*	3*	39
	36	57	115	10	36	20	181

* No secondary cases.

† Two cases ascribable to oysters. In a large proportion of cases no history could be obtained.

‡ Including one secondary case.

§ Including four secondary cases due to personal infection.

‖ Including two doubtful cases.

Thus the total number of cases originating in the towns during 1893-4-5-6 was *181.*

Of these the percentage (*a*) in which a negative history as regards shell-fish was obtained was	3·5
(*b.*) In which the history was doubtful was ...	5·5
(*c.*) In which the origin was ascribable to oysters	19·9
(*d.*) In which the origin was ascribable to other shell-fish	11·1
	100·0

Milk Supply.—The following statement as to milk supply deals with the cases of enteric fever having a local origin during 1894-5-6.

In 1894 there were twenty-one cases ascribable to shell-fish. These had fourteen distinct milk supplies. Two cases were supplied with condensed milk. One milkman supplied two patients in different streets. In three cases the milk supply was unknown.

The thirty-three cases ascribed to other causes than shell-fish had fifteen milk supplies where this could be ascertained. In eleven cases the supply was unknown. One milkman supplied three cases, and two milkmen supplied two cases each.

In 1895 there were fourteen primary cases ascribable to shell-fish, having five known milk supplies, two from condensed milk, and five unknown. Two milkmen supplied two cases each.

The thirty-seven remaining cases had fourteen known milk supplies. In nine cases the milk supply was unknown. There was one milk supply for five cases (these occurred in a public institution and were caused by personal infection), one milk supply for five cases also due to personal infection, and one supply for three other cases. Three milkmen supplied two cases each.

In 1896 the ten cases ascribable to shell-fish had eight sources of milk supply and two from condensed milk.

The twenty-six remaining cases had twenty-one sources of milk supply. There were three cases in connection with one milk supply.

It should be stated that in every instance the ultimate source of the milk supply was ascertained. The facts it need hardly be said do not lend themselves to the supposition that milk infection was operating in either of the two groups of cases; but much less so in the cases ascribable to shell-fish, than in those ascribable to other causes. The source of milk supply was not always ascertainable: but so far as known the facts for 1894-5-6 are as follows:—

Forty-five cases ascribable to shell-fish had thirty-three known separate milk supplies.

Ninety-three cases not ascribable to shell-fish had forty-seven known separate milk supplies.

Streets affected.—The following are the data as to streets in which cases of enteric fever occurred in 1894-5-6.

1894. Shell-fish cases—twenty-one cases in nineteen streets. In two instances in different streets two cases occurred in one house.

Non-shell-fish cases—thirty-three cases in twenty-four streets. Three cases in one house in two different streets, and three other cases in single houses in one of those streets. No drain common to more than one house, in these or any of the subsequent cases.

1895. Shell-fish cases—fourteen streets involved in fourteen primary cases; four secondary cases, from personal infection in one house, and one secondary case in another house.

Non-shell-fish cases—twenty-seven streets involved in thirty-seven cases, four cases in one house in E. street, three cases in one house and one case each in two houses in C. street, two cases in one house in P. street, do. in S. street, and five cases in one public institution.

1896. Shell-fish cases—ten streets involved in ten cases.

Non-shell-fish cases—twenty-two streets involved in twenty-six cases, two cases in one house in two streets, two cases in two houses in one street.

Thus in the shell-fish cases in 1894-5-6, forty-five cases occurred in forty-three streets; while in the cases ascribable to other causes, 96 cases occurred in seventy-three streets.

It is evident therefore that there was no common cause at work in any special neighbourhood, such as infection through sewers or water mains. It may be added that the streets in question were scattered throughout the whole town, not being specially clustered in any one district.

The 115 cases in which a negative history as regards shell-fish was obtained require futher attention. The ninety-six of these cases occurring in 1894-5-6 may be arranged as follows:—

	1894.	1895.	1896. (To Aug. 4)	Totals.
A. There was a history of personal infection from some preceding case	7	14	3	24
B. There were defective house drains but no history of other cases	12	10	12	34
C. No evidence as to source of the disease could be ascertained, though enquiries were made	14	13	11	38
	33	37	26	96

The cases under heading (*A*) require little further comment. They illustrate the too little recognised dangers of nursing enteric fever by amateurs, or in houses where the best arrangements are impracticable.

The cases under heading (*B*) comprise houses in which along with cases of enteric fever defective drains were found. It may be stated that these were usually drains passing under houses, and the test employed was the hydraulic test, which reveals defects often not discovered by volatile agents. All new drains in the town are thus tested, and during the three years, 1893-4-5, 1,739 old drains which had been found defective were relaid and made absolutely water-tight.

In the cases under the heading (*C*), there was a negative history as to shell-fish, there was no history of possible infection from previous cases, and no defects of house sanitation could be detected. It would thus appear that in thirty-eight local cases out of the 96 total local cases, no source of the disease could be detected. It must, however, be remembered that in urban conditions of life it is much more difficult than in rural conditions of life to trace the antecedents of each patient during the three weeks preceding his attack. Sometimes the patient himself could not be questioned, and we had to trust to the recollection of the wife or some other relative who was not completely cognisant of the doings of the patient at the time when the infection was received. I cannot, therefore, think that there is much weight in the argument that some unknown cause, or causes, which operated in the 38 cases under the heading (*C*) may have been at work in the 56 cases which have been ascribed by me to sewage-contaminated shell-fish. The slight importance which might attach to such an argument disappears when we weigh the facts in connection with each individual case, and the proof to be given later of gross contamination by sewage of other shell-fish from the same source as those ostensibly causing the cases of enteric fever.

The cases under heading (*B*) are more open to difficulty. Here were 34 cases of enteric fever, in which the only ascertainable circumstance bearing on the cases, was the presence of defective house sanitation. There is no town which has done more than that in which I live to perfect its system of house sanitation, and each year the proportion of houses which will bear the most rigid tests of modern sanitation is largely increased. It is very doubtful whether many of the cases of enteric fever in which defective house-drainage was found were really caused by this. Assuming, however, that they were caused by drain effluvia, we have further to consider the fact that in 21, not including five secondary cases due to infection, of the shell-fish cases occurring in the three years, 1894-6, there were also defective house drains, while in 24 of the shell-fish cases during the same years the house drains were perfect. In the shell-fish cases associated with defective drains may not the latter have been the cause of the enteric fever? In answering such a question, we must have regard to considerations of probability. There is no such thing as certainty in actual life. The only problems capable of actual proof or demonstration are mathematical. It is our duty and practice in daily life to decide in each given case according to the balance of probability. We cannot state this better than in the words of Bishop Butler in his Analogy.*

"In questions of difficulty, or such as are thought so, where more satisfactory evidence cannot be had or is not seen, if the result of examination be that there appears on the whole any, the lowest presumption on one side and none on the other, or a greater presumption on one side, though in the lowest degree greater, this determines the question even in matters of speculation; *and in matters of practice will lay us under an absolute and formal obligation in point of prudence and of interest, to act upon that presumption or low probability, though it be so low as to leave the mind in very great doubt which is the truth.*"

Applying this valuable and authoritative rule to our present case, there can be no doubt that enteric fever is much more likely to be caused by the eating of sewage-contaminated shell-fish than by the inhalation of drain-effluvia. Nearly every large outbreak of enteric fever in recent years has been traced to the swallowing of specifically contaminated water or milk. As investigation has become more exact, the number of outbreaks attributed to the inhalation of effluvia has steadily diminished, and it is generally admitted that enteric fever is much more commonly caused by the ingestion than by the inhalation of the specific infection. The case may be put thus: given evidence that the shell-fish ingested by the about-to-be-patients are contaminated by sewage *(vide postea)*, and given that the ingestion of sewage-contaminated food is much more likely to cause enteric fever than the inhalation of sewage-contaminated air, we are bound, in view of the balance of probability, to conclude that when these two possible causes are present, it is the shell-fish which are the active cause of enteric fever in these particular cases. Such a conclusion is consonant with reason and common sense, even where there is but a "presumption or low probability;" but I venture to say, that in this instance we have to deal with a high degree of probability, which leaves very little ground for dispute.

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* Vol. I., page 3, Clarendon Press Edition.

One further point remains to be considered, in reference to the group of cases in which one person only out of several persons eating shell fish developed enteric fever. This simply indicates what might, on *a priori* considerations, have been anticipated.

Not every one receiving a specific infection developes the specific disease. There must be a suitable *soil* as well as *seed*.

There is no reason to suppose that every oyster in a given purchase is specifically contaminated with the typhoid bacillus. As a matter of probability one would not expect this. The circumstances are totally different from epidemics of enteric fever originating from contaminated milk or water. Here it is reasonable to expect that the virus might be uniformly diffused throughout the fluid. And yet in such epidemics only a certain proportion of the persons drinking the infected material develope the disease.

In the famous Marylebone outbreak of enteric fever in 1873, of 760 families supplied from the infecting dairy, 15 per cent. were invaded by the disease.

We should expect on *a priori* grounds that the percentage of persons attacked (stated in terms of the total number of persons partaking of the food in question) would be very much smaller in a shell-fish outbreak than in an outbreak caused by infected liquids. The exact number of persons eating the oysters from the contaminated source it is impossible to ascertain. Many slighter cases of actual illness escape detection.

Local Conditions affecting the Shell-Fish.—We have now given the direct evidence connecting the cases previously tabulated with the consumption of oysters or other shell-fish. Nearly all these oysters and mussels (there were 36 cases ascribable to oysters and 20 to mussels) were directly traced to one particular source. At this place the condition of things was such that the oysters, laid down between high and low water mark, were exposed to contamination with sea-water containing a large amount of suspended sewage twice a day; and the mud remaining behind in contact with the oysters showed evidence of the presence in it of sewage.

The sewers discharging near these oysters contained the sewage of several thousand persons.

The mussels indicated in the preceding cases grew in a river bed below the point of discharge of the sewerage of several thousand persons.

Bacterioscopically the water derived from close to the oysters was certified by Dr. Klein, F.R.S., to shew "distinct evidence of being polluted with sewage to a considerable degree."

Connection of Cases with Cases probably contaminating the Shell-Fish.—Only one further link in the chain of evidence is required to connect the oysters and mussels with the cases of enteric fever in the town. Were there cases of enteric fever, the excreta from which drained into the river from which the oysters and mussels were derived, rendering it possible for them to cause any of the cases of enteric fever ascribed to shell-fish? The cases notified under the Infectious Disease (Notification) Act in a portion of this drainage area have been most kindly placed at my disposal. From another portion I can obtain no information, and the following tabular statement is to this extent incomplete. It is further incomplete, owing to imperfect notification. Thus, in 1895, there were two deaths from enteric fever and only five cases were notified, which gives a fatality of forty per cent.; while in 1894 there were three deaths out of five cases notified, giving a fatality of sixty per cent. In view of these figures it is fairly certain that a large share of the cases of enteric fever in these villages remained unnotified, though they none the less polluted the water in which the oysters were bathed twice a day.

DATES OF NOTIFICATION.

Cases of Enteric Fever in the Districts Draining into the River near the Oyster and Mussel Beds:—

1893—
March 29.
May 19.
" 27.
August 4.
" 14.
September 13.
October 14.
November 7.

1894—

Cases of Enteric Fever attributable to Oysters and Mussels from the same source:—

1893—
August 10.
September 3.
" 25.
October 4.
" 26.
November 21.
December 27.

1894—
February 1.
March 6.
" 15.
" 20.
" 26.
" 28.
" 28.

DATES OF NOTIFICATION—Continued.

s of Enteric Fever in the istricts Draining into the iver near the Oyster and ussel Beds:—	Cases of Enteric Fever attributable to Oysters and Mussels from the same source:—
1894—	1894—
	April 3.
	„ 3.
June 16.	„ 18.
July 31.	July 14.
August 27.	August 14.
September 6.	„ 28.
October 25.	October 19.
	November 19.
	„ 26.
	December 2.
	„ 8.
1895—	1895—
January 27.	February 15.
March 8.	August 26.
	September 3.
	„ 8.
	„ 15.
	„ 18.
	„ 25.
October 1.	October 6.
„ 6.	November 19.
November 21.	„ 26.
	December 3.
	„ 6.
1896—	1896—
	January 2.
	„ 2.
February 17.	„ 18.
March 15.	„ 20.
	April 15.
	„ 23.
	May 4.

withstanding these defects, the tabular statement ap-
l appears to me most suggestive. The longest apparent
l between a case of enteric fever notified in the villages
ıg on the river bank on which the oyster ponds are
and corresponding cases attributed to the eating of
derived from these ponds is between three and four
s. In actual fact, it is reasonable to believe that it was
less than this.

raises the question as to how long the typhoid bacillus
rvive under the conditions here described.

Experiments on viability of typhoid bacilli in oysters. A.—Professor Rubert Boyce, M.B., Professor of Pathology, and Professor W. A. Herdman, D.Sc., F.R.S., Professor of Zoology in University College, Liverpool, described at the Ipswich meeting (1895) of the British Association experiments made by them.

They summarise their experiments bearing on the present question as follows:—

"IV.—*The toleration of sewage, &c.* It was found that oysters could, up to a certain point, render clear sewage-contaminated water, and that they could live for a prolonged period in water rendered opaque by the addition of fœcal matter; and that the fœcal matter obtained from cases of typhoid was more inimical than that obtained from healthy subjects."

"V.—*The infection of the oyster by the micro-organisms.* The results of the bacteriological examination of the water of the pallial cavity of the oyster, and of the contents of the rectum, showed that in the cases of those laid down in the open water of the bay the colonies present were especially small in number, whilst in those laid down in proximity to the drain pipe the number was enormous (*e.g.*, 17,000 as against ten in the former case). It was found that more organisms were present in the pallial cavity than in the rectum. In the case of the oysters grown in water infected with the *bacillus typhosus*, it was found that there was no apparent increase of the organisms, but that *they could be identified in cultures taken from the water of the pallial cavity and rectum fourteen days after inspection.*"

"It is found that the typhoid bacillus will not flourish in clean salt water, and our experiments seem to show, so far, that it decreases in numbers in its passage along the alimentary canal of the oyster."

B. Dr. Charles J. Foote, of the Yale Medical School, U.S.A., found that the typhoid bacilli were alive forty-eight hours after being placed in the interior of the shell of a living oyster, and the same time after inoculation into the oyster. Experiment was not continued beyond this time.

Experiments on viability of typhoid bacilli in sea water.—Experiments of Giaxa show that the typhoid bacilli can maintain their vitality in sea water, sterilized or not, for many days (quoted in the "British Medical Journal," page 392, February 16th, 1895).

Experiments of Freytag show that the typhoid bacillus will live six months in a concentrated solution of salt.

Foster has also shown that the typhoid bacillus will resist the action of a saturated solution of salt for weeks, and even f months. (Quoted by Dr. C. J. Foote, Report of Connecticut State Board of Health for 1894, page 265.)

Viability of typhoid bacilli in fresh water.—Cassedebat examining the drinking water of Marseilles (a very hot-bed of water-borne typhoid fever), could not find the characteristic bacilli in one out of 250 cultivations made of 70 specimens of water, though he found closely resembling bacilli.

The reason was not, as pointed out by Cassedebat, because the typhoid bacillus will not live in water, because in distilled water to which a cultivation of typhoid bacilli was purposely added, he could distinguish their presence *at the end of forty-four days*, and when they were added to distilled water along with half a dozen other forms, they were still living and active at the end of seventeen days. ("Annal de l'Institut Pasteur," October 25th, 1890.)

Klein ("Twenty-fourth Annual Report of the Local Government Board," Supplement of the Medical Officer, page 417) found in some experiments that "by adding in the first instance large numbers of typhoid bacilli—always, be it noted, along with a trace of nutritive material—to samples of London water, sterilized by filtration before inoculation, living bacilli were recoverable therefrom, in two out of the three samples, even after the lapse of eight weeks."

Experiments on viability of typhoid bacilli in sewage.—Messrs. Lawes and Andrewes in their Report to the London County Council showed that typhoid bacilli inoculated into sterilized sewage died within a few days, when the sewage was maintained at 37° C. At 20° C., the ordinary temperature of the air, the duration of their life was longer but probably not over a fortnight.*

It is necessary to note that—(*a*) these were laboratory experiments, not made under natural conditions.

(*b*) Only small quantities of the sewage were tested, and the negative results are therefore not conclusive.

(*c*) Further, it has been shown above that the typhoid bacilli will live for months in sea water; and that they will live in oysters inoculated with them at least fourteen days. (Boyce and Herdman.)

Later experiments made by Klein on similar lines ("Twenty-fourth Supplement of the Medical Officer to the Local

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* These experiments while perfectly trustworthy on the *minimum* side, almost certainly do not indicate the maximum duration of life of the typhoid bacillus in the soil, as it is impossible to say that the negative results obtained at the end of a given time, prove the actual absence of living typhoid bacilli.

Government Board," page 407) showed that colonies of typhoid bacilli remained in sterile sewage at the end of three weeks from the time of its artificial inoculation. Furthermore, in sterile sewage to which nitrates had been added, the typhoid bacilli continued to exist in enormous numbers at the end of eight weeks.

Duration of viability of typhoid bacilli in soil.—This has an important bearing on the infection of the oysters to which the preceding cases are ascribed, as these were derived from ponds in close propinquity to enormous mud banks, largely composed of sewage sludge.

Stevenson and Murphy's Hygiene, Vol. II. p. 320, states: "it is now generally admitted that the enteric fever organism is capable of thriving in the soil. It is a common experience in rural districts, and apart from sewerage systems, to observe the disease hang about a particular locality. Once introduced into a village, it will often recur regularly as the Autumn comes round, invading households deriving their water supply from different wells, households not possessing community of insanitary conditions of a sort to explain the fever. This seems consistent with a specific organism capable of abiding in the soil, multiplying therein at its proper season, and so contaminating the soil over considerable areas."

Dr. Sims Woodhead mentions that typhoid bacilli in fœces kept in a sterilized tube remained alive at the end of fifteen days. ("Bacteria and their Products," p. 198.)

MM. Grancher and Deschamps came to the conclusion as the result of their researches that the typhoid bacillus "retains its life in the midst of all the organisms the soil contains five-and-a-half months after it has been sown." (Archiv. de Med. Experim. et d'Anatom Path. No. 1, Jan. 7, 1869, quoted in "Public Health," p. 57, Vol. III.)

Karlinski found that the typhoid bacillus lived in earth three months; that when buried with typhoid excreta its duration of life was shorter than when buried with blood; and that it lived longer in the deeper than in the more superficial layers.

Dr. Dempster (1894) found that in *sterilized* soils the typhoid bacillus retained its vitality as follows:—

1.—Dry soils, evaporation not prevented, white crystal sand up to ninth day; yellow sand up to eighteenth day; garden earth up to fourteenth day.

2.—Moist soils, evaporation not prevented, in white sand bacilli alive on twenty-third day; in yellow sand and garden earth forty-second day.

Summary of Evidence—The evidence associating as cause and effect the eating of shell-fish with the cases of enteric fever may be thus summarised.

A. There were four groups of cases of enteric fever ascribable to shell-fish.

1. The only person eating shell-fish was the only person acquiring enteric fever.
2. Other persons eating shell-fish at the same time had minor ailments.
3. Defective house drains were found in the houses in which the eating of shell-fish was followed by enteric fever.
4. Not all the persons eating shell-fish developed enteric fever.

In the first group, the proof is as positive as it is possible to have it in such an inquiry; and the general statement that there is danger in eating shell-fish from certain sources, and that the public have a right to be protected from this danger may be based on these cases.

The evidence derived from the second group of cases strongly confirms this conclusion.

In the third group we have to balance probabilities. Knowing that enteric fever is much more generally traced to contaminated food than to the inhalation of drain or sewer effluvia, and assuming that the shell-fish in question (*vide postea*) were contaminated by sewage, the weight of probability, which as practical men we are bound to accept, is greatly on the side of the view that these cases were caused by eating the sewage contaminated shell-fish, and not by inhaling drain effluvia.

In the fourth group, we note that

(*a*) A special soil, as well as a special seed is required to produce enteric fever.

(*b*) It is not reasonable to assume that every shell-fish from a sewage-contaminated source contains the typhoid bacillus.

(*c*) Even when an outbreak of enteric fever is caused by contaminated milk or water only a small percentage of the persons drinking these are attacked.

B.—1. The ponds from which the oysters were derived and the bed of the river from which the mussels were derived, to which the preceding cases are ascribed, were subject to gross contamination by sewage.

2. The water and mud from the oyster pond gave bacterioscopic evidence of sewage contamination.

3. There were cases of enteric fever in the districts draining into the above river, in close contiguity of time to the cases which I have ascribed to oysters and mussels from this source.

Addendum.—The following point as to age and sex distribution of the cases ascribed to shell-fish as compared with that of other cases, although I do not wish to press it, appears to me to have some significance.

In the Three Years 1894-5-6 :—

	Males.	Females.
(*a*) Cases in which there was a negative history as to shell-fish	44	53
(*b*) Cases imported into the town	21	20
(*c*) Cases attributed to shell-fish	30	21

Thus among the cases attributed to shell-fish *58·8 per cent. of the cases were among males,* while in imported cases (in which the question of shell-fish could not be worked out) the proportion of males and females was nearly equal; and among patients in which there was a negative history as to shell-fish *only 44·9 per cent. of the cases were among males.* It is notorious that oyster eating is much more largely a male than a female indulgence.

In the Three Years 1894-5-6 :—

	Aged—		
	Under 20.	20—30.	30 & over.
(*a*). Cases in which there was a negative history as to shell-fish	44	16	36
(*b*). Cases imported into the town......................	17	10	14
(*c*). Cases attributed to shell-fish	18	15	18

Thus among the cases attributed to shell-fish, 61·1 *per cent. of the cases were of adults over* 20, while in imported cases 58·5 per cent. were of adults over 20; and in cases in which there was a negative history as to shell-fish, 54·2 *per cent. of the cases were of adults over* 20.

The list of occupations is also very suggestive. It can scarcely be a coincidence that occupations like the following should preponderate among the shell-fish cases:—

Insurance Agent.
Betting Agent.
Manager of Theatre.
Publican.
Waggonette Driver.
Police Constable.
Commercial Traveller.
Wife of Fishmonger.
Cityman.
Merchant.
Wife of Caterer.
Medical Practitioner.
Restaurant keeper.
Errand boy at fishmonger's shop.

Five of the patients were Convalescents from some other ailment, for whom oysters had been ordered.

I have now completed my task. It may be interesting to add that the Corporation of Brighton, anxious to ensure their visitors and residents from imported, as they have done from indigenous, sources of disease, attempted during last session of Parliament to obtain the local powers embodied in the following clause of their Local Improvment Bill.

> "In case the Medical Officer of Health is in possession of evidence that any person in the Borough is suffering from infectious disease attributable to the consumption of shell-fish supplied within the Borough, from any pond, river or other place, situate within or without the Borough, in which shell-fish are commonly kept, bred or cultivated, and in which pond, river or place such shell-fish have been (or are liable to be) exposed to contamination by sewage, or that the consumption of shell-fish from such pond, river or place is likely to cause infectious disease to any person residing in the Borough, such Medical Officer shall, if authorised in that behalf by an order of a Justice having jurisdiction in the locality in which such pond, river or place is situate, have power to inspect such pond, river or place, and all shell-fish, matters and things therein, and if on such inspection the Medical Officer of Health is of opinion that the infectious disease is or is likely to be caused by the consumption of shell-fish supplied from such pond, river or place, he shall report thereon to the Corporation or to the Sanitary Committee of the Council, and the Corporation or the Sanitary Committee, as the case may be, may thereupon give notice to the person by whom such shell-fish is so kept, bred or cultivated, to appear before them within such time, not being less than twenty-four hours, as shall be specified in the Notice, to show cause why an Order should not be made prohibiting the supply within the Borough of any shell-fish from such pond, river or place, until such Order has been withdrawn by the Corporation or the Sanitary Committee as the case may be, and if in the opinion of the Corporation or the Sanitary Committee, as the case may be, such person fails to show such cause then the Corporation or such Committee, as the case may be, may make such Order as aforesaid, and the Corporation or such Committee, as the case may

be, shall forthwith give notice of the fact to the Sanitary Authority and County Council (if any) of the district or county in which such pond, river or place is situate, and also to the Local Government Board. An order made by the Corporation or such Committee as aforesaid in pursuance of this section shall be forthwith withdrawn on the Corporation or such Committee, as the case may be, or the Medical Officer of Health being satisfied that the cause of the infection has been removed. Any person refusing to permit the Medical Officer of Health, on the production of such Order as aforesaid, to inspect any such pond, river or place, or after any such Order prohibiting the supply of shell-fish as aforesaid has been given supplying within the Borough any shell-fish from such pond, river or place in contravention of such Order, or selling it for consumption in the Borough, shall be liable to a penalty not exceeding Five pounds, and to a daily penalty not exceeding Forty shillings. Provided always that proceedings in respect of such offence shall be taken before the Justices of the Peace having jurisdiction in the locality where the said pond, river or place is situate. Provided that no person on whom an Order prohibiting the supply of such shell-fish has been made by the Corporation or such Committee as aforesaid shall be liable to an action for breach of contract if the breach be due to such Order. Every person who shall wilfully obstruct such Medical Officer or other officer of the Corporation assisting him in the exercise of the powers of this section shall be liable for such offence to a penalty not exceeding Five Pounds."

It was drafted so as to give similar powers to those conferred on Local Authorities adopting the Act by the Infectious Disease Prevention Act, relating to milk; and the mode of procedure is the same in both cases. The Corporation through their Counsel intimated to the Parliamentary Committee their willingness to accept any power of appeal to the Court of Quarter Sessions or to the Local Government Board which might be suggested.

The clause was disallowed. It was opposed by neighbouring Local Authorities, because it introduced the "vicious principle" of inspection by a medical officer of health outside his own district; and by the Local Government Board, on the ground, I believe, that any powers to be given relative to shell-fish should be general and not local, and that they were at that time engaged through one of their medical inspectors on an investigation of the whole subject. The plan of the Local Government Board is one contrary both to precedent and to the public interests. The majority of the important health clauses of the Public Health Amendment and the Infectious Disease Prevention Acts were embodied in Local Acts obtained by various Corporations throughout the country for years before they were crystallized into the above-named *Adoptive*

Acts. It is not creditable to the Local Government Board that it should lag behind Local Authorities in their attempts to secure more efficient means to prevent the spread of disease, and still less so that the Board should obstruct these Local Authorities in their attempts.

The opposition of neighbouring Local Authorities raises a point which has already been settled in principle in favour of the clauses promoted by the Brighton Corporation in the powers relating to milk, above referred to. If it is undesirable that any medical officer of health should be disallowed to trace the disease arising within his district to its probable source without his district, there is certainly need in this as in many other matters for the immediate co-operation of inspectors of the Local Government Board to prevent the continued existence of sources of disease which the local health officials are not allowed to investigate.

Sir JOSEPH EWART (Brighton) said he had seen the accuracy with which Dr. Newsholme had pursued his investigations for two years, and he arrived, after the most careful and attentive consideration, at identically the same conclusion as Dr. Newsholme had. Those of them who had read the history of typhoid fever as distinguished from common continued fever, by Jenner, would recollect how, after putting the whole facts to the profession, Dr. Jenner was opposed, and what a long time it took, before the profession throughout the whole country were convinced that the facts given by Dr. Jenner were true, and that typhoid was a separate disease. He (Sir Joseph) happened himself to go out to India a short time after Jenner had published his researches, and having studied in London at a time when typhoid fever was very common, when the whole profession were engaged in testing whether Jenner's work was correct or not, and having satisfied himself that Jenner's views were correct, he (Sir Joseph) found the same conditions amongst the natives of India. To show how difficult it was to get attention rivetted on any of those things, it took the official members of the profession in India many years before they would enter typhoid fever as a distinct fever in their official returns. No wonder, then, that Dr. Newsholme and those who had made similar observations should meet with some difficulty in getting an official recognition of the case he had put before the profession. He felt as convinced as he did of anything that Dr. Newsholme was in this matter supported by the great probabilities of the facts being true. If that were so, and if the government could be convinced, they should have the means placed at the disposal of the health officers of the country, by the agency of which a large proportion of the typhoid fever which occurs, and cannot otherwise be accounted for, would be prevented. There was apparently great fear, on the part of the Local Government Board, of offending the trading interests, but where the general health of the community was concerned, the Whitehall authorities should give way. Sir Joseph was pretty certain that the oyster trade itself would not suffer, but would ultimately benefit. Once the profession and public became convinced that the cultivation of oysters was carried on free from sewage contamination, he thought a great benefit would be obtained by the trade. The opposition which they met at the House of Commons in Committee was an opposition which was a self-interested one. The health authorities wanted only to have the same powers over oyster beds as they now had over milk. That was all, and once such a power was granted there would be no difficulty in enforcing the cultivation of the oysters under pure, wholesome and healthy surroundings. They should also contend for this, that so far from the oyster industry suffering in any degree, it would be largely benefitted by the immense security given in the public recognising once and for all that the food was as wholesome as it possibly could be.

Sir CHARLES CAMERON (Dublin) said it was exactly seventeen years since, at a meeting of the British Association, he propounded the theory that enteric fever was sometimes propogated by means of oysters taken from the estuaries of rivers into which the sewage of large towns was deposited. He gave bacterial results of the examination of oysters taken from Dublin Bay, and he thought he gave the strongest proofs that it was highly probable that enteric fever was communicated by means of shell-fish. He was sorry to say that his observations were not received with much credence, and he was asked in all seriousness by the Chairman of the section, whether what he had been saying was not one of his (Sir Charles Cameron's) usual jokes. For ten years it might have been regarded as a joke, but for the last few years he found that papers had been read from time to time, and even official documents issued, showing that the infection of oysters by sewage was by no means an infrequent occurrence. It was a curious thing that what he wished to prove seventeen years ago, that there was a possible danger in eating uncooked the oysters from our larger rivers and from the bays into which the sewage from large towns empty, was only now becoming generally accepted. Since that time he had had many opportunities of seeing the effects of oysters taken from polluted sources, and not only enteric fever, but other attacks of a nature similar to that produced by eating tainted food—choleraic attacks were due to that cause. He published not long ago a case of fourteen people being attacked by cholerine after eating oysters. He had also recorded a terrible case—a tragedy—that occurred on the shores of Dublin Bay not long ago, when a whole family died after eating mussels which were taken from an extremely filthy pool of water, and which he found to be in a diseased condition. All the mussels had increased to an enormous size, for mussels had livers as well as men. He thought Dr. Newsholme had done a good work in bringing that paper before the members of the Congress.

Dr. **Willoughby** (Eastbourne) said he had at the present time in the Infectious Diseases Hospital, at Eastbourne, six serious cases of typhoid fever, due, in his opinion to the eating of oysters. He was first struck by the fact that the patients were all men of from twenty-five to thirty-five years of age. Taking that fact into view, and studying the cases, he found that the patients had had oysters from one particular stall at one part of the town at a certain period. All the milk supplies were different, their houses were fairly good, they lived in different parts of the town, in fact, there was nothing in common except that the patients had had oysters from that particular stall. He traced the source of these oysters and found that they came from near Dublin. That neighbourhood Sir Charles Cameron had more than once spoken of. He was sure the public at large would be much indebted to Dr. Newsholme for bringing the matter forward.

"*Milk Control, Milk Inspection, and Milk Laboratories,*" *by* G. Sims Woodhead, M.D., F.R.C.P.

The Report of the Royal Commission appointed to enquire into the effect on human health of food derived from tuberculous animals brings out no single fact more clearly than that many of those on whom depends the maintenance of public health find it impossible to shake off the trammels of tradition, especially as they bear on the causes of tuberculosis, and nothing to my mind was more interesting than the tenacity with which certain of the witnesses examined before the Commission clung to what some people look upon as almost incapable of proof—the "hereditary transmission" of tuberculosis. On the one side we had a number of men, physiologists and others, who fought for this hereditary transmission, and, in some cases, for tuberculous "atavism;" whilst on the other side those who have been compelled to study tuberculosis most closely, maintained—with one or two exceptions—that although it might be difficult to disprove hereditary transmission in a certain number of cases in which it is claimed such transmission has taken place, undue prominence is given to the possibility of such transmission, attention being thus diverted from the real causes and methods of tuberculous infection, which are to be looked for rather in the inhalation and ingestion of tuberculous material from tuberculous patients—human and animal.

I am one of those who do not believe that direct hereditary transmission of tuberculosis takes place except in those cases in which (1) there is general tuberculosis of the mother, or (2) the uro-genital organs of the father or mother are affected, and where there is such affection—as one sometimes sees in cattle—the rule is that the fœtus does not come to proper birth at full time. This being the case the commission very wisely tabooed this part of the question and turned its attention to sifting the evidence regarding, and making experiments on, the subject of the propagation of tuberculosis through the ingestion of the meat and milk of animals suffering from tuberculosis. It is with one of these branches of the question that I shall deal in the short time at my disposal. I do not intend to describe any special method of sterilising or rendering innocuous milk that has become infected with tuberculous material. We have a right to expect that in the case of such an important article of diet as milk, it shall at any rate be derived from uncontaminated sources, and although for the present it may be necessary to disinfect it by heat according to methods which are now, I hope, thoroughly well recognised, arrangements must be made to control the production and distribution of milk in such fashion that, ultimately —it is to be hoped at some not distant date—it will not be necessary to take precautionary measures, such as heating and the like, in order to be sure that it contains no living tubercle bacilli.

After a careful study of the question of milk control in France, Germany, Denmark, and Sweden, I am convinced that until the medical officer of health, the veterinary surgeon, and the "Local Authorities" can act together and in full accord we shall not attain an ideal control of our milk supply. In the course of my work I have had to deal with a very large number of diseased animals of various kinds, and although I may claim that I have picked up a very fair knowledge of the pathology of the diseases of animals, and an amateur knowledge of the symptoms beyond that gained by most medical men who have not gone through a special course of veterinary training, I have not the slightest hesitation in saying that wherever I want a reliable opinion on any animal, or whenever I desire to learn anything about the natural history of a disease in an animal, I at once appeal to a veterinary surgeon; and in most cases I am thoroughly satisfied with the opinion that I get. I do not say that I would take the opinion of every veterinary surgeon, even against my own, but I am satisfied—and my experience of this matter is a very extensive one—that a good veterinary surgeon, especially one who has been well trained in comparative pathology—as the younger generation of veterinary surgeons undoubtedly are—will give a more reliable opinion than a medical man of the same standing, and this, naturally, without any disrespect to the medical man.

How, it may be asked, can the veterinary surgeon and the medical officer of health act together in such an important question. I will not attempt to go into quotations and statistics as to the number of tuberculous cattle in the various countries of the world. These have been so fully given and are now in the hands of so many Medical Officers of Health that it would be a work of supererogation to repeat what is now common knowledge. I will try rather to sketch what to my mind would be a useful and at the same time a practicable system of control: a plan by which the medical officer of health would obtain a greater amount of information and control than he does at present, and would at the same time retain an increased amount of time and energy to devote to the important work that he has in hand; whilst he would have special advice on those matters of which he cannot be expected to have the same knowledge as a veterinary expert.

Every dairy should be registered—the number of cattle and the number of workers being carefully noted; each worker and each animal should have its own bill of health; the medical officer and the veterinary surgeon should, together, go over the accommodation for the cattle, the ventilation and the general conditions of the cow-houses. This being done the veterinary surgeon should, every fortnight, pay a visit along with the medical officer of health, and each should examine his own patients—the doctor noting the health of the workers, making enquiries as to their general condition, and noting down anything in the hygienic condition of the house or the state of health of the inmates that may seem worthy of notice. Whilst this is being done, the veterinary surgeon should examine a certain proportion (one-half) of the dairy stock, so that every animal is examined at least once a month. But, in addition to this, each animal that is found to be suffering from any disease and especially from disease of the udder, or from tuberculosis of any kind, should be carefuly isolated and examined at each visit, and until the veterinary surgeon gives a certificate that such isolated animal may again go into the dairy, none of the milk from such animal should be allowed to be sold; it may be boiled and given to the pigs, or it may be boiled and then thrown away, but it should never be allowed to go into the supply for human consumption, or allowed to be thrown away even in the raw state.

It is not necessary to go into further detail, but it is only proper that I should justify such frequent inspection and that, I think, I cannot do better than in the following part of my report to the Commissioners appointed to consider this question of tuberculosis. "It is often a very difficult matter to state whether cattle are tuberculous or not, and in some instances before the use of tuberculin became general, it was impossible to make out tuberculosis when confined to the abdominal and thoracic glands, and to the serous membranes of these cavities, even in a fairly advanced stage, the general condition of the animal being all that there is to help the veterinary surgeon to make the diagnosis. It has also been pointed out that tuberculosis of the udder may develop not only in well marked cases of tuberculosis, but also in cases such as those above described, in which the udder lesion develops with such extreme rapidity that although indistinguishable at one visit of the veterinary surgeon, it may be well developed on a second visit a fortnight later, this lesion in such a case being the first distinctly recognisable indication of tuberculosis in the animal. Should the intervals of inspection be greater than a fortnight, the value of the inspection would be enormously diminished, so far as the protection of the consumers of milk, against what must now be recognised as a very grave danger, goes. Beyond this, however, it has been pointed out that the tubercular lesion of the udder may occur at any period of the disease, not only when it has been localised to the glands or to special cavities, but also when the disease has become much more generalized."

In the above quotation tuberculin is mentioned as a diagnostic agent in tuberculosis, and there can now be very little doubt that it will be part of the duty of an inspecting veterinary surgeon to apply the tuberculin test at intervals, especially when there is the slightest suspicion that an animal may be tuberculous; any falling off in condition or suspicious symptoms of any kind indicating the necessity for the use of this diagnostic agent, whilst even healthy herds will receive no damage from the periodic use of tuberculin, and cases of tuberculosis will be discovered which would otherwise escape detection. The experiments made abroad are in most cases convincing enough, but the experiments carried out by Prof. McFadyean and by Sir Thomas Gibson Carmichael, M.P., on a large scale and on a smaller scale by other stock owners have put it beyond doubt that tuberculin must now be relied upon as a regular adjunct to the weapons already in our hands with which to fight the difficulties of diagnosis in tuberculosis.

A detailed report of this inspection should naturally be made to the Medical Officer of Health, and a permanent tabular record kept of all observations made by the veterinary inspecting surgeon. I may say that I lay special stress on this part of the inspection, as I am afraid that there has been a tendency amongst Medical Officers of Health to minimise the importance of veterinary inspection, and to take exception to the association of the veterinary surgeon with the Medical Officer of Health in looking into this matter. When, however, we consider the enormous amount of work that already falls upon the shoulders of the Medical Officer of Health, and when, at the same time, one takes into consideration the type of veterinary surgeon that is now being educated in the various colleges in England and Scotland, one cannot help feeling that not only will it be a relief as regards actual work, but the moral support of an expert in animal pathology will be very great indeed. We, of all men, who are so jealous of our own rights, should be the last, I think, to step into the domain of men well qualified to carry on the work of examining cattle, both alive and dead. In connection with this part of the matter I should here like to throw out a hint—though this, perhaps, is scarcely the place for so doing—that some special diploma might be granted to those veterinary surgeons who have distinguished themselves in the study of the pathology of the specific infective diseases, and who would thus be a special class from whom the veterinary inspectors might be selected.

So much for the veterinary side. Once the nature of the disease is understood and the importance of keeping tuberculous cows out of the dairy stock recognised, the question of isolation, ventilation, exercise and proper feeding will soon take a recognised position and the hygiene of the dairy will be properly regulated.

Whilst this inspection is being carried on in the cow-houses the Medical Officer of Health must turn his attention first to the hygienic surroundings of the inhabitants and workers on the dairy farm, and secondly to the workers themselves. It is now fully recognised that a case of scarlet fever on a dairy farm, or a case of typhoid, may be a focus from which either of these diseases may be disseminated over large areas to which the milk from the farm is supplied. But it has not yet come within the range of "practical politics" to apply the same rules to any case of tuberculosis or phthisis which may occur. When one considers the conditions under which milk is handled uncontrolled from the outside, one is absolutely astounded that phthisical patients should be allowed to remain on the dairy farm and be employed in helping to collect and distribute milk, and I feel that it is impossible to emphasize too strongly the necessity for placing phthisis in a schedule of infective diseases, patients suffering from which should never be allowed to remain in any dairy farm. A patient suffering from such disease, if allowed to remain on a dairy farm, is a menace to the public health, and those responsible should be dealt with accordingly.

But registration and inspection of this nature should not be confined to the dairy farm. As you know, much of my work is carried on in the laboratory, and it may be, perhaps, that I am too much impressed with the necessity for making periodical examinations of milk obtained from various sources inspected by the veterinary surgeon and the medical officer of health, but during the last few years I have been so much impressed with the amount of tuberculous material that has been sent out along with milk, demonstrated either by microscopic examination or by injection into small animals, that I am convinced that no system of control, for many years to come at any rate, will be complete that does not include a careful laboratory examination—especially for tubercle bacilli. Before the work of the Tuberculosis Commission was commenced I was able on three occasions at least to demonstrate the presence of tubercle bacilli in milk that had been sent out or that was being used for human food. In one instance we had an experiment on a very large scale, the milk from certain cows being given to a series of young pigs because it was not required for human food. The majority of these pigs would not fatten, wasted, and were killed young, when they were found to be suffering from well marked tuberculosis of the alimentary tract.

During the carrying out of the work for the Tuberculosis Commission several cows were bought directly or indirectly almost straight from dairy farms. These animals were fed with milk which was being distributed certainly to within a very short time of their sale to us, and in one or two cases the tubercle bacilli were so numerous that it was a very easy matter to demonstrate numbers of bacilli in a single field of the microscope; whilst in other cases, where the bacilli were not so numerous, injections into guinea pigs were followed by extensive tuberculosis. Quite recently, out of eight samples of milk that were sent to me from the dairies of a large city I found that although no tubercle bacilli could be demonstrated under the microscope, in two cases a sufficiently large number were present in the milk to set up well marked tuberculosis in guinea pigs injected. Such examples might be multiplied to a very considerable extent, but these concrete cases serve to indicate the great importance of a bacteriological examination, at any rate until the conditions under which our cattle are kept, registered, and inspected are materially improved. It may be objected that it would be a difficult matter to have such examinations carried on, and that the expense would be so great that it would be difficult to obtain the consent of local authorities to sanction the cost of such examinations in addition to all the expense that would be involved in connection with registration and inspection. In these matters, although we are far ahead in what is called practical sanitation, we are still very much behind our Continental neighbours, who are not afraid to spend as large sums on examination of food for materials which may bring about the death of the consumers as they spend on the analysis of food substances for comparatively innocuous, if non-nutritious, adulterating materials.

This question of expense is surely not one to be put to the fore front when the saving through the lessened incapacity from disease, and the diminution in the loss of life, with the consequent increase in the working power, and a corresponding gain to the community, would far outweigh even very large sums laid out in the manner I have indicated.

As to the facilities for the carrying out of these bacteriological investigations, Great Britain and Ireland are now so well supplied with laboratories that there is practically no district in which the medical officer of health need be at a loss as to where to send the milk for examination. It is not a far cry from Newcastle, where there is a well equipped pathological laboratory, to Edinburgh or Glasgow or to Manchester, Leeds and Liverpool, and from thence to Birmingham, Oxford, Cambridge and London, in any of which arrangements could be made, and no doubt are at present made on a small scale, for the examination of milk that is suspected of containing tubercle bacilli.

Of course, all that has been said as regards the inspection of dairy farms and the bacteriological examination of the milk therefrom, applies with equal force to distributing agencies of all kinds. At one time it seemed to be the idea that milk should be distributed by a general dealer, and most of us have seen stores in which milk, vegetables, firewood, and eggs were dispensed on one side of the room, and coal from a kind of alcove on the other side; whilst in the rear of the house was a rag and bone depôt in which much business was done. Things are a little better than that now-a-days, but there still remains much to be done in the matter of registration and inspection of the distributing dairies.

In the large cities abroad, and even in London and some of our larger cities, these small milk retailers are being driven out by the large dairy companies, most of which are managed on admirable lines and which we hope, at no distant date, to see co-operating still further with the Medical Officer of Health and the Veterinary Inspector in stamping out tuberculosis.

The best of these associations are almost all of them voluntary, and in a free country like ours where so much is left to individual effort, we cannot help thinking that similar voluntary associations started in our large towns would gradually relieve medical officers of health of much anxiety on the score of milk, and would at the same time obtain such a hold over the producing farms that here also the duties of the Medical Officer of Health, and the Official Veterinary Inspector would be reduced to a minimum; whilst the confidence that well-managed companies would enjoy, would go a long way to make and increase their dividends. This increase of dividend would arise from the fact that not only would such dairies obtain a large portion of the trade, but should the outlay, in the first instance render it necessary, they would be enabled to obtain slightly higher prices for milk which they could guarantee free from tubercular infective elements.

I have not attempted to burden this paper with facts, and in a certain sense this may be a disadvantage; but I have so recently had the opportunity of recording an enormous number of experiments which are now public property, that I have thought it better to give in brief outline a general opinion on the milk question, asking you to remember, however, that this opinion is based upon a very extensive experience of the methods adopted both at home and abroad, and upon a greater number of experiments than has been recorded by any other investigator with whose works I am acquainted. I make this statement, not, I wish you to understand, from any lack of modesty on my part, but simply to indicate that I am not generalising without having at command a considerable number of facts and experiments from which to draw my conclusions. Some of the points that have been raised will I hope, be freely discussed.

[*For discussion on this paper see page* 432.]

On "Bovine Tuberculosis in relation to Public Health," by W. Hunting, F.R.C.V.S., late President of the Royal College of Veterinary Surgeons.

Some facts bearing on this question are beyond dispute and may be stated without argument.

(1) Tuberculosis is prevalent amongst the cattle of Great Britain.

(2) Bovine tuberculosis is a danger to public health owing to the infection of meat and milk.

(3) Bovine tuberculosis is a serious cause of loss to stockowners and therefore a national loss.

(4) The danger to human beings and the loss inflicted on stockowners are sufficient to warrant legislative interference.

(5) The parties concerned are the stockowner, the meat and milk traders and the consumer; the last may be taken as equivalent to the taxpayer.

In framing a scheme for dealing with bovine tuberculosis, we must be guided by the ascertained facts as to its nature, methods of spread and transmission to other animals. We are assisted by the experience of foreign countries and by the success which has attended legislation at home against analogous diseases.

Every case of tuberculosis originates by the entrance of a specific causal organism, into the system of an animal. Unsanitary conditions cannot give rise to the disease, but may facilitate the transmission of the organism from diseased to healthy stock, and, when productive of debility, favour the rapid development of disease in individuals.

The clinical signs of tuberculosis are recognised by veterinarians in all advanced cases, and the post-mortem lesions are well known. The difficulty which existed a few years since, in diagnosing the disease before the advanced stages were reached, has been removed by the use of tuberculin. There is then no difficulty in detecting tuberculosis in animals either dead or alive. There is no doubt as to its cause or as to its methods of spread. Inhalation, ingestion or inoculation of the bacillus or of spores, are the sole methods of infection. The experiments of Bang of Copenhagen, have settled, beyond dispute, that heredity is not a factor in the spread of the disease, and therefore no provision need be made for exceptional dealing with pedigree stock or brood animals.

The general plan which has been found successful in stamping out other contagious diseases of animals, may be applied to the suppression of tuberculosis. No two diseases exhibit quite analogous conditions. Each has some special feature which requires special provisions. Tuberculosis has some special features in its methods of spread, in its slow development and in its relation to man, but it has none which is not comparable with the features presented in some one of the numerous diseases that have already been dealt with under the Animals' Diseases Act. Cattle-plague, foot and mouth disease and pleuro-pneumonia have been suppressed. Rabies and glanders have in many districts been successfully controlled. All these diseases spread by contagion from animal to animal of the same species. Some are transmissible to other species than the one infected. Glanders and rabies are communicable to man.

Tuberculosis has the peculiarity of developing very slowly, or in other words, of existing for a long period without affording clinical indications of its existence. The same thing is noticed in glanders.

Latent and unsuspected tuberculosis in cattle may transmit infection to other animals. An analogous condition obtains with glanders in horses.

Partially developed cases are difficult to diagnose clinically. This occurs in tuberculosis of cattle, and in glanders of horses. Mallein may be relied upon to confirm the diagnosis of the one disease in horses, and tuberculin is equally trustworthy in detecting the other disease in cattle. The law has provided for doubtful cases of glanders in horses by special regulations for "suspicious" cases, and a similar rule could be applied to cattle suspected of tuberculosis.

It has been found practicable to allow free movement of horses showing no sign of disease, although cases of glanders have been removed from the stable in which they stood. Similar regulations might be applied to herds from which tuberculous animals had been separated.

The great feature which distinguishes tuberculosis from other contagious diseases of animals, is that meat and milk for human consumption are infected by the disease in bovines. Special provisions are therefore necessary to meet this danger, and no analogy exists in any of the regulations which now form part of the Animals' Diseases Act.

The general principles which have been followed in dealing with other animal diseases, may safely be applied to tuberculosis. The regulations which have been successfully enforced to suppress cattle plague, pleuro-pneumonia and foot-and-mouth disease have been justified by the fact that those diseases were a national loss which could be prevented. The regulations required to suppress tuberculosis, are called for not only to prevent a national loss of wealth, but by a higher claim—the prevention of a danger to human life.

I assume that it is absurd to try and protect human beings by inspecting meat and milk, whilst doing nothing to control the source of infection, or to limit the disease in the animals from which meat and milk are derived. Any scheme to protect man must be conjoined with one to protect animals.

The essential step is to include tuberculosis in the Animals'

Diseases Act, and to apply such regulations as have been found beneficial in suppressing analogous diseases of animals. Much might now be done without special parliamentary action, by a simple Order of the Board of Agriculture, but success would be more complete and certain if the whole subject were dealt with in a distinct and separate Act.

As a scheme for such an Act the following is offered:—

(1) *Compulsory Notification* by the owner of the existence of tuberculosis in an animal or a carcase.

This is essential to any legislative action, as it is only after the discovery of disease that any regulations can be enforced. There is nothing novel in the suggestion. It is now applied in relation to every contagious disease of animals which either causes great loss of animal life, or is a danger to human beings. It is enforced against rabies to protect man and against pleuro-pneumonia to protect cattle. It ought to be enforced against tuberculosis for both reasons.

(2) *Isolation of Infected Animals* when ordered by the local authority or its inspector.

This power is possessed in relation to all the diseases at present scheduled in the Animals' Diseases Act. It is absolutely necessary for the control of any contagious disease.

(3) *Application of the Tuberculin Test* to animals that are suspected or which have been in contact with diseased ones.

Unless there is evidence that tuberculin does no harm to healthy animals and that its reaction is reliable, its compulsory use cannot be justly sustained. That it does no harm to healthy animals has been conclusively proved by the experiments of Professors Law of Cornell University, McFadyean of London, Bang of Copenhagen, and Nocard of Paris. The same authorities have convinced themselves, by careful and extensive experiments, of its reliable action as a test of the presence or absence of tubercular disease. Many other veterinarians in this kingdom have also used tuberculin, including Professors Penberthy and Dewar. All are satisfied with its reliability—all save a few who have had no experience of it.

It has been said, as an argument against the use of tuberculin, that it is possible by its action to convert a case of local infection into one of general infection and thus to produce disease in organs which were previously free. There is no evidence of this in cattle, but even if such result followed in a small percentage of cases it would not be a serious disadvantage. The life of an individual animal is of small concern in carrying out repressive measures against disease; and the effect of more rapidly developing disease in an infected animal would only be to confirm diagnosis and to hasten the time of slaughter.

(4) *Compulsory Slaughter of all Animals* showing distinct clinical signs of the disease. This regulation has been applied to every disease included in the Animals' Diseases Act. A horse worth £100 found to be suffering from glanders may now be slaughtered on payment of his carcase value. A milch cow suffering from well-developed tuberculous disease is more dangerous to man than the horse and seldom worth more than a fourth of the value mentioned. Every argument in justification of slaughtering the horse applies with increased force to the slaughter of the cow.

(5) *Compensation* to be paid by the local authority for every animal slaughtered, to the extent of one-fourth the value, and no animal to be valued at more than £30.

Parliament has always recognised the principle of paying compensation for animals compulsorily slaughtered. Slaughter is enforced for the public good and not merely in the interest of the owner of a diseased animal. Were slaughter compulsory without compensation, notification of disease would often be evaded and then the detection of infected stock would be extremely difficult. The experience gained in carrying out the Contagious Diseases (Animals) Act during the last thirty years, has shown conclusively that the co-operation of owners can only be obtained by payment of liberal compensation, and that without the co-operation of stock-owners the regulations cannot be successfully put in practice.

It has been objected to compensation, that the stock-owner has no more claim on the public purse for loss resulting from disease, than has any other trader for loss to his plant or stock from accident. Disease as a cause of loss, cannot be put on the same footing as accident, or as such events as rain, lightning and other natural causes of injury. A contagious disease in this island can be stamped out, and its re-appearance prevented. If any other trade risk could, by a reasonable expenditure, be entirely and permanently removed, there would be good argument for that expenditure. The loss from contagious disease amongst live stock is not analogous to other trade losses, and if it can be shown that the cost is not too great, and that the measures proposed show a reasonable and not too remote probability of success, then the expediency of compensation is established.

Another objection made to the payment of compensation, is "that it would lead stock-owners to be more negligent, and that some might endeavour to make a profit out of their diseased animals." If the full value of animals were paid as compensation, and no repressive measures accompanied the payment, this objection would have some basis of reason. No owner of stock ever yet had contagious disease amongst his animals without suffering serious loss, and payment of one-fourth the value of an animal cannot possibly recoup his loss. Compensation is never paid except for slaughter, and the right to demand compensation can only come after notification. In other words, compensation is only paid to the owner who has detected an outbreak of disease, and enabled the authorities to put in force all the measures with which they are armed for the suppression of the disease. Repressive measures without compensation lead men to refuse notification of disease, and encourage them to hide an outbreak whilst they get rid of infected animals, and so spread the malady to other centres.

The only reasonable objection to compensation is when it may reach such an amount as to exceed the value of suppression. To rashly slaughter every animal in which tuberculosis could be detected, by clinical observation and by the use of tuberculin, would lead to such an enormous expenditure that no authority dare countenance it. There is no necessity for any such wholesale proceeding. Only the advanced cases would be immediately slaughtered, the rest would be isolated for trade purposes until such time as they had fulfilled the requirements of their owners or were fit to be killed, and meantime the spread of disease would be prevented.

(6) *Cleansing and disinfection* of infected places would of course be enforced.

(7) *An implied warranty of freedom from tuberculosis* should be enforced from the vendor of any animal sold for over £8 or less than £30, "for the purposes of meat or milk." This would do away with the complication of the question which now results from the condemnation of carcases in the possession of butchers, or the condemnation of cows kept for milking purposes. It would make the butcher and cow-keeper automatic detectors of diseased stock, and it would be no hardship on the stock-owner who would be assisted by the compensation paid him under the Act. It would force all parties concerned to take the most careful precautions against disease; whilst by eliminating the only incentive to the utilisation of a diseased animal by cow-keeper or butcher, *i.e.*, pecuniary loss, it would protect the public health. The warranty might be limited to ten days from the time of purchase. This would afford sufficient time to the butcher for slaughter, and to the cow-keeper for applying the tuberculin test. The resolution adopted at the British Medical Association, that the butchers' loss should be equally divided between the local authority, the seller, and the butcher is complicated and impracticable. Who would collect the different shares, and what is to prevent the buyer and seller taking advantage of the local authority?

That the seller should be responsible for a hidden defect is no novelty in law. The Sale of Goods Act already admits the principle, and at least one Court of Law in Scotland has decided that the sale of a tuberculous animal for meat does really come within the provisions of the Act. Nearly every European country recognises the responsibility of the seller, so far as a sale for "meat" is concerned. I venture to think that its application to "milk" is quite as urgent, just and expedient.

Such a scheme as I have drawn for the protection of our herds against loss, and for the protection of human beings against disease, should be carried out by local authorities, and not by a central office in London. The stamping out of pleuro-pneumonia was effected by slaughter of every head of cattle on the infected premises. The superintendence of such a course could be undertaken from a central office. The suppression of tuberculosis does not require such a drastic measure, but it necessitates the gradual extinction of disease by the repeated slaughter of single animals at intervals of uncertain time, and therefore can only be supervised by an expert resident in the locality. A central authority is required such as the Board of Agriculture or the Local Government Board to control and assist the local authorities by enforcing some general and uniform action.

As a supplementary measure, probably veterinary inspection of cow sheds and slaughter houses would be desirable; and the home producer will doubtless insist upon inspection of foreign cattle, meat and milk.

[*For discussion on this paper see page* 432.]

"*An Anti-tuberculosis Programme*," *by* H. SCURFIELD, M.D.

(MEMBER.)

THE discovery that tuberculosis cannot develop without the entry into the body of the tubercle bacillus has made it quite clear that every case of tuberculosis must be due either to infection after birth or to infection before birth. The statistics of abattoirs and the use of tuberculin have shown that infection before birth is a very rare occurrence in cattle, and there is every reason to suppose that the same rule holds good for man.

Dr. Russell says: "Putting aside, as of no practical importance, the very rare case of inheritance of the bacillus, man, like other animals, suffers from tuberculosis only when he receives the bacillus from without."

The difficulty of tracing the origin of any one case of the disease is not surprising, when we consider how many are the possible sources of infection, and how long an interval may elapse between the entry of the bacillus into the body and the appearance of evident signs of the disease.

As an example of how frequently tuberculosis may exist unsuspected, of the 902 post-mortems made at the Bledgdams Fever Hospital, Copenhagen, from 1884 to 1889, on children under 15, who died of epidemic diseases (diphtheria, scarlet fever, &c.), tubercular changes in one or more organs were found in 288 cases or in 31·3 per cent.

The following table shows these results: —

Age.	Number of post-mortems.	Cases of Tuberculosis.	Percentage of cases of Tuberculosis.
0 to 3	430	89	20·7
3 to 6	334	139	41·6
6 to 9	98	46	46·9
9 to 12	35	14	40·0
12 to 15	5	0	0

Granting that infants are born free from the disease, what more convincing evidence of its infectious nature do we require than the fact that consumption runs in families? Does this not mean that the disease is passed on by infection from one member of a family to another?

Again, overcrowding *per se* cannot cause consumption, but it is easy to understand that if one of the overcrowded individuals suffers from a tuberculous discharge, the chances of the others becoming infected will be in direct proportion to the amount of overcrowding.

The predisposition of any individual to the disease or in other words the ease with which he can take it, must be an unknown quantity till he has taken it. Measures to prevent infection must therefore be taken by all alike.

The chief sources of danger are, firstly, human beings with a tuberculous discharge, pulmonary consumptives with an expectoration being the most important, and secondly, cattle affected by the disease.

(1). My first proposal is that some system of notification of human tuberculosis, at any rate when accompanied by a discharge, is desirable. On receipt of the notification, the Health Department would supply the family of the patient with instructions pointing out how to deal with the sputum or other discharges, the importance of ventilation and of keeping the patient's rooms free from dust, the disinfecting properties of sunlight, &c. The instructions would of course lay stress on the importance of the patient observing the precautions for his own sake, lest he should lessen his own chances of recovery by re-infecting himself. The instructions would not have to be of an alarmist nature, but must point out clearly the precautions to be observed in order that a consumptive may live in a house without risk to the other occupants.

The Health Department would also disinfect the room and bedding after death, and supply disinfectants or disinfect at such other times in the course of the illness as might appear necessary. If the deficiency of accommodation in the home made it impossible to take the proper precautions, for example, if the consumptive could not be supplied with a separate bed or a suitable amount of cubic space, the question of providing "homes for consumptives" would have to be considered. These homes need not be in any sense "isolation hospitals." Fewer restrictions would be necessary and more liberty for going out or seeing friends and relatives permissible. As fever hospitals are now provided at the cost of the community for the protection of the community, it would be no great departure to provide "homes for consumptives" in a similar way and for a similar object.

One of the objections to notification is the expense. The number of new cases of tuberculosis with a discharge would be approximately equal to the number of deaths from tuberculosis annually. This would mean about 200 to 250 cases for a population of 100,000, or about half the average number of notifications from scarlet fever. Therefore expense cannot be called a serious obstacle.

Again, some say that notification is unnecessary because you only have to see that the sputum never dries and there is no danger. The same might be said of the sputum of diphtheria, or the excreta of typhoid patients, and yet these diseases are notifiable, and we provide hospitals for their reception.

Is it so very much easier to destroy the sputum and other discharges of consumptives than to disinfect the excreta of typhoid patients?

Can a consumptive in a violent fit of coughing spit with such precision that all the sputum can be collected and rendered harmless?

To consider another objection, I do not think that general practitioners would resent the assistance of the Health Office in cases of tuberculosis any more than in cases of other infectious diseases; and, if they did, the difficulty might be overcome by making the notification voluntary, and supplying all the qualified practitioners with copies of the instructions issued in cases of tuberculosis. The fear that notification and precautions would brand the consumptive as a social outcast is, I venture to think, without foundation.

Dr. Russell, in his pamphlet, reminds us of the famous men who have been included in the army of consumptives in the past, apparently as a plea for not being too active in preventive measures; but it is only fair to argue that, if such precautions as I have indicated be adopted, famous men will have less chance of becoming consumptives in future.

Dr. Russell also points out the importance of popular instruction on the subject, and, in my opinion, notification and some such routine as I have referred to, would be a direct and not expensive method of imparting this instruction.

My next proposals deal with the danger to man from tuberculosis in cattle. It may be said that by boiling all milk and thoroughly cooking all meat, these dangers would be minimised; but there is an æsthetic objection to consuming tubercle bacilli, either roast or boiled, and I think no one will contest the advisability of our doing all that we can to lessen or stamp out bovine tuberculosis.

Competent authorities estimate that from 20 to 30 per cent. of the adult cattle in this country are affected in some degree by tuberculosis. The question of getting rid of the disease altogether is, therefore, an enormous one. The tuberculin test provides us, however, with an accurate and ready method of separating the animals affected from the animals not affected.

I would suggest:—

(1) That Sanitary Authorities should urge the management committees of hospitals, workhouses, schools, asylums, etc., in their districts to give the preference to farmers who will supply milk from herds guaranteed free from tuberculosis by the tuberculin test.

(2) That Sanitary Authorities should advertise from time to time in local newspapers lists of farmers who supply milk from herds guaranteed free from tuberculosis by the tuberculin test, in order that private consumers may know where to obtain such milk.

With reference to these proposals it has now been shown in France and Denmark and other countries that the tuberculin test is the only means of separating the animals affected from the animals not affected. If a herd be tested and all the reacting animals got rid of, and all the subsequent purchases be only introduced into the herd on condition that they stand the test, that herd will remain free from tuberculosis.

The general use of tuberculin in this way would stamp out tuberculosis in cattle, and it is in order to encourage the beginning of such a scheme that I bring forward proposals for the purpose of creating a demand for tubercle-free milk.

It must naturally occur to the members of the committees of such institutions, "If we take these precautions for the inmates of this hospital, why do we not do the same for our own families?" The community would probably have to pay an extra price for such milk at first. The farmer would ultimately benefit by having no further losses from tuberculosis. It is hardly necessary to mention that no person suffering from tuberculosis should have anything to do with the farm work, for fear of reintroducing the infection.

A beginning has been made in this country. Several breeders use tuberculin and several farmers supply milk from herds guaranteed in this way.

The committee of the Sunderland Fever Hospital have decided in future to give the preference to farmers who supply milk from guaranteed herds, and the committees of the Sunderland Infirmary and Monkwearmouth and Southwick Hospitals are taking steps in the same direction. The importance of patients in hospital and especially typhoid patients being supplied with such milk is obvious, and the fact that tuberculosis is one of the recognized sequelæ of typhoid fever is suggestive.

My next proposal is that the Government be urged (1) to supply the tuberculin test free of charge to all farmers, who agree to get rid of the animals shown by the test to be affected, and to only add to their herds in future such animals as stand the test: and (2) to insist on the marking of all animals which, when tested, show the reaction; and to enact that such animals be sold only for slaughter, and be slaughtered only under the supervision of qualified meat-inspectors.

The first of these proposals is intended as an encouragement to the farmer to take measures to stamp out the disease. A somewhat similar scheme is at present at work in Denmark, and the farmers there have availed themselves of it in large numbers. Up to August, 1895, 1675 herds, comprising 46,495 animals, had been tested, and 18,399 animals, or 35·4 per cent., were shown to be affected; 255 of these 1,675 herds were quite free from tuberculosis, thus showing that the disease is not ubiquitous.

The second proposal is intended to meet the obvious objection to an animal shown to be infected being simply passed on to another herd, or being sold as meat without being properly examined.

The marking is rendered the more necessary by the fact that an animal which reacts to the test once, sometimes fails to react when tested again shortly afterwards.

The veterinary inspectors under the Contagious Diseases (Animals) Acts would seem to be suitable officials for carrying out these measures.

My last proposals are that it is desirable:—

(1) That public abattoirs be established in every urban district, and that the use of them for slaughtering purposes and meat examination be made compulsory, and

(2) That full compensation be given to butchers for the carcases of animals condemned for tuberculosis, when these animals have been bought *bonâ fide* as sound, and before slaughter showed no signs of disease or wasting.

The former proposal needs no comment as it is notorious that meat inspection without public abattoirs is more or less of a farce. With regard to the latter, putting aside the butcher who speculates in doubtful beasts as deserving no sympathy, it will I think be deemed fair that a butcher who does his best to buy sound beasts should not suffer for what is no fault of his. If anyone ought to suffer it is the farmer who is responsible for the spread of the disease. The carrying out of such a measure would be simple, where only public abattoirs were in use, because the examination of the beast before slaughter would suffice to show whether it had been bought as sound or not. Where there were no public abattoirs, the veterinary inspector of the market might be empowered, on payment of a small fee, to certify that beasts sold in the market showed no signs of disease or wasting and thus entitle the purchaser to compensation, if the carcases were subsequently condemned.

In apology for the ambitious title of my paper I must plead that it is intended as a delicate compliment to the city in which we are met, which has somewhat of a reputation for programmes.

At the conclusion of the paper, Dr. Scurfield proposed the following resolutions—

"That this Section recommends to the Council of the Institute:—

"1. That some system of notification of human tuberculosis, at any rate when accompanied by a discharge, is desirable.

"2. That sanitary authorities should urge the Management Committees of Hospitals, Workhouses, Schools, Asylums, etc., in their district to give preference to farmers who will supply milk from herds guaranteed free from tuberculosis by the tuberculin test.

"3. That sanitary authorities should advertise from time to time in local newspapers lists of farmers who supply milk from herds guaranteed free from tuberculosis by the tuberculin test, in order that private consumers may know where to obtain such milk.

"4. That the Government be urged: firstly, to supply the tuberculin test free of charge to all farmers 'who agree to get rid of the animals shown by the test to be affected, and to only add to their herds in future such animals as stand the test; and, secondly, to insist on the marking of all animals which, when tested, show the re-action, and to enact that such animals be sold only for slaughter, and be slaughtered only under the supervision of qualified meat inspectors.

"5. That public abattoirs be established in every district, and that the use of them for slaughtering purposes and meat inspection be made compulsory.

"6. That compensation be given to butchers for the carcases of animals condemned for tuberculosis when these animals have been bought *bonâ fide* as sound, and before slaughter showed no signs of disease or wasting."

NOTE.—The opinion of the Council upon the resolutions passed at this Congress will be published in Vol. XVIII., Part [illegible].

[*This discussion applies to the papers by* Dr. G. SIMS WOODHEAD, Mr. W. H. HUNTING *and* Dr. H. SCURFIELD.]

Dr. R. SYDNEY MARSDEN (Birkenhead) said he thought that they had been very much gratified that morning with the large amount of interesting matter which had been provided by the three gentlemen who had read these papers. Dr. Woodhead's position in connection with the subject of tuberculosis was unique in this country, and every thing which he said must carry with it, the very greatest weight with every person that was connected with the meat and food supply of Great Britain. Dealing with Dr. Woodhead's remarks first, he would say that he was not quite in unison with his views on the method of dealing with meat inspection at the present time. It might not be known to all present, though it was to a good many, that he had to deal with one of the largest meat supplies in the whole of Great Britain, being at Birkenhead, which is one of the meat centres in this country. Dr. Woodhead said that the only proper person, the only practically competent person to inspect meat was a veterinary surgeon. He had constantly, at previous meetings, combated this idea. He did not combat this idea of the veterinary surgeon being the most competent person if properly educated, but he was dealing with matters as they exist at present. He had no doubt that in the next generation the veterinary surgeon would be the most competent, and the man who would be best able to take up the matter of meat inspection; but at the present time, as a Medical Officer of Health, his experience was that a great many of the veterinary surgeons now practising, were very imperfectly educated with regard to pathology. He had seen many of them in the witness box, and one had only to see them there, giving evidence in some cases, to find out that the average veterinary surgeon was very much behind his times, and yet they are the very persons who we are told were the only ones qualified to act as meat inspectors, and to give evidence on such matters. The present generation of veterinary surgeons is receiving a very much better education in pathology than its predecessors, and as a Medical Officer of Health, he should certainly be the first to welcome their entry into this important branch of work, but he must still protest against the general view going out that the only person capable of acting as a meat inspector was a veterinary surgeon. He had constantly advocated that a well educated butcher with a vast experience in the meat trade, and with a good training in the scientific portion of the work, under a Medical Officer of Health, was the most competent and able man, and was most thoroughly fitted to do the work. That was their experience in Birkenhead, and they had the reputation in the trade of being the most strictly inspected town in the country. He would pass on to the paper which had been read by Mr. Hunting. He was the individual who moved the resolution at the Carlisle meeting of the British Medical Association to which Mr. Hunting had taken exception. He took the ground that a person who supplied any article of food to the public ought to supply it free from adulteration of any kind, and that meat was no exception to the rule; but, recognising a certain amount of hardship to a butcher going into the open market and buying, very often in perfect good faith, animals that afterwards prove to be diseased, he thought buyers should have some compensation given to them. At the same time he thought a very careful watch should be kept so as to detect those who are habitually getting carcases from infected stocks. Mr. Hunting said that the proposal which he (Dr. Marsden) made, was that the farmer or trader should pay one-third of the compensation, that one-third should be paid by the butcher, and that the sanitary authority, as representing the public should pay one-third, was impracticable, and that the shares could not be collected. He did not know that Mr. Hunting's plan was any more practicable, and he failed to see why the third-shares could not be collected. He took it that the authority would pay one-third to the butcher, who would have the power to collect (or stop from the purchase money) from the farmer from whom he purchased, or whoever was the seller, his third of compensation, and thus the shares would be easily adjusted. He saw no difficulty in the matter. Dr. Scurfield said that he considered that the best thing to be done would be to have all Stock in the country tested with tuberculin, and that the owners of such Stock as had successfully stood the test, should receive certificates of immunity from the sanitary authority. He was very much opposed, as a representative of a sanitary authority, to giving certificates of immunity, in any case whatever; they were chickens which often come home to roost at inconvenient times. He therefore invariably carefully avoided doing it. He did not think any of them would care to certify, for instance, a house which had been redrained. He did not know what the custom of other Medical Officers was, but considered it a dangerous plan to give certificates of absolute immunity, and to give certificates in the case of Stock, would be dangerous, and often misleading to the public. He could not agree with Dr. Scurfield in this respect, though, of course, with the general tenour of the whole of the papers they must all be in absolute unity.

THE PRESIDENT OF THE SECTION (Professor Corfield) said he had perhaps better state that no amendment could be put to those resolutions. The last speaker had made some remarks which were in opposition to the proposals, and he therefore thought it better to state that fact now.

Dr. JAMES NIVEN (Manchester) said he rose to second the proposals made by Dr. Scurfield, which, in his opinion were eminently practical. At the recent meeting of the British Medical Association, the branch on "Public Health" carried a resolution practically unanimously, to the effect that some system of notification of human tuberculosis, when accompanied by a discharge, was desirable. It seemed unnecessary to enter into a discussion on that subject, as Dr. Scurfield had given the reasons for it, which were essentially the same as those put forward at the meeting to which he had referred, and he did not think that at this stage there could be any difference of opinion on the subject. But the other proposals which Dr. Scurfield put forward were mainly new. The first of these was that Sanitary Authorities should urge the management committees of hospitals, workhouses, schools, asylums, &c., in their district to give preference to farmers who would supply milk from herds guaranteed free from tuberculosis by the tuberculin test. This guarantee of freedom by the tuberculin test was, he would venture to say, new to most of them, but it was apparently not a new thing. It seemed that Bang, in Copenhagen, had been carrying out very extensive experiments in that direction, and that he had succeeded in getting a very large number of farms, something like 1,170, in Denmark examined by the tuberculin test, not partially, but entirely, and under the condition that the farmers should exclude from the general herd all animals found to be infected with tuberculosis. Now if they also took into account the fact, which they would find in Dr. Scurfield's paper, that a very simple mode of exclusion, such as putting up a partition in a cowshed, between sound and unsound cattle, was sufficient to prevent the spread of disease, it was clear how extremely important as a preventive of the spread of tuberculosis that measure must be. It also showed that it presented a means of entirely arresting the course of tuberculosis in cowsheds at a comparatively small expense, and indeed the fact that so many farmers in Denmark were adopting that method was a very clear indication that that was the light in which they regarded it. Now if that were so, the next proposition of Dr. Scurfield's was a most necessary and a most proper one to put forward, and he thought, if adopted, would give the means to obtain a voluntary arrest of tuberculosis in our cowsheds. He did not see why certificates should not be given. We were obliged to give certificates for a very large number of things, and it would not be necessary, probably, for Dr. Scurfield's purposes, to give more than a certificate that the farm was pronounced by a veterinary surgeon free from tuberculosis by the tuberculin test. He did not see why any Sanitary Authority should not give such a certificate as that. It would bind them practically to nothing except to a statement that such a test had been carried out, and that the animals had been pronounced free. At any rate if they got the examination carried out by a veterinary surgeon in whose integrity and in whose opinion they had every confidence, he saw no reason why they should not grant such a certificate. He saw also no objection to the fourth proposition, that the Government be urged to supply the tuberculin test free of charge to all farmers, &c. That had been adopted in Denmark with very much success. Whether it would not be preferable in this country for the County Councils and Local Sanitary Authorities to take up the administration of this procedure, he would not venture to say positively, but he thought possibly it might be better. In Manchester the Corporation had given permission for veterinary surgeons to use tuberculin in the examination of the animals and the cow-sheds; that is to say to procure tuberculin at the public expense, and to use it in the examination of animals. The difficulty was, of course, that of objection by the cow-keeper, but as Dr. Scurfield's proposal only contemplated voluntary action he could not see why there should be any objection offered to the Central Government, or to the Local Authority (which he presumed would answer equally well) supplying this tuberculin. He did not think it necessary to say anything about the fifth resolution as to the establishment of public abattoirs, about which they were probably all agreed. As to the sixth resolution, that compensation be given to butchers for the carcases of animals condemned for tuberculosis. He thought that compensation should be given in respect of cattle found to be tuberculous if it could be clearly proved that the animals might bonâ fide be regarded as sound, but he thought if they gave compensation for all cattle killed in that way it would lead to very grave abuses. The farmer who brings a tuberculous animal into the market about which there was clear evidence of tuberculosis ought to be severely punished rather that compensated. Compensation ought to be given in cases where it can be shown with tolerable clearness that the farmer had no evidence of tuberculosis. With the insignificant exceptions which he had mentioned he thought such a programme as that could be carried out. A great deal had been done in Denmark already, and a great impetus would be given to the prevention of tuberculosis in this country. He would remind them too that they must not only prevent tuberculous animals getting into the market, but they must also take thorough measures to prevent the propagation of the disease from one animal to another in the cowshed, and also to prevent the infection of our rural population by tuberculous animals—objects which imply improved arrangements in our cowsheds as well as the efficient administration of the laws and regulations relating to them.

Councillor James Willock (Glasgow) being very much interested in hospitals and connected with the hospital in Glasgow, and being also one of the Health Committee of that city, said he would like to refer to the papers which had been before them that morning. In Glasgow they had had under consideration the milk supply in hospitals. The present method was that the Medical Officer inspects, for sanitary purposes, all farms, but never up to the present had any tuberculin test, or any other test, been applied to the animals on those farms. A very interesting experiment was made quite recently by the bacteriologist of one of the Medical Schools in Glasgow. (There was no bacteriological department, but such a department was being formed, and they would then be able to carry out thorough examinations). This medical man took from the dairies surrounding the hospital, thirty different samples of milk, each of which he put to a bacteriological test for the purpose of finding out whether tuberculosis existed in any of these. Out of those thirty samples of milk, twenty-seven, so far as he could make out, were free, and three were infected with tuberculosis, more or less. The Medical Officer, with the consent of the Health Committee, helped with these enquiries, and went to the farmers and said, "We don't know whether these animals are really infected, but we are quite prepared to do this: if these animals on being slaughtered are infected we pay nothing: if they are in a healthy condition we pay the full value." The farmer gladly agreed to it, and it was found on slaughtering two animals that they were infected. He did not think the farmer suffered altogether, as some compensation was given to him. He had only mentioned this to show how important a matter it was that the milk supplies for hospitals should be put to a test; that was to say, the animals should be put through the tuberculin test, for the milk supply may have a great effect upon the fever patient, especially if the case be one of enteric fever. He noticed remarks in a local newspaper recently, about meat inspection, to the effect that butchers and others had better avoid Glasgow as far as meat was concerned, they having had a very severe test there. He was sorry to say that one thing they were deficient in at Glasgow was their meat inspection. It might surprise them to learn that while the Corporation have the markets of Glasgow under their charge, the inspector in the markets was a man holding a policeman's certificate. He had had some years' experience now—a good many years' experience—but he was nothing more nor less than a policeman: indeed, he believed he was a sergeant now, but he did not think that even the three stripes on his arm made him any more fit to undertake meat inspection. The Sanitary Authority have no control in the market, and they can only stand outside and watch the meat coming out. He had seen the policeman's report, and it was something like this—"Made inspection one carcase from so-and-so: twenty-eight hundred-weight; fourteen hundred-weight condemned; sixteen hundred-weight sound; signed by"—a policeman. What they wanted, and what they were trying to bring about, was that the Sanitary Authorities should have this matter in their hands. As to the homes for consumptives, a departure had been made in Glasgow, though it had been done on philanthropic lines, and they had had opened recently a Home for Consumptives. He would like to say this, that whilst homes for consumptives would admit cases from poor homes, and help and relieve suffering, it would not help you in your work very much. It was patients in the first stages that medical men wanted in order to see what could be done. However, he thought it was a step in the right direction, and had a great future before it.

Dr. F. Vacher (Birkenhead) said he felt himself so much in accord with the programme which had been sketched by Dr. Scurfield that he was loath to say anything in criticism, even of its details. As regarded the suggestions by Dr. Sims Woodhead, he regretted that he was not present to hear them, nor did he hear the whole of Mr. Hunting's paper. He thought it most important that in the matter of the prevention of tuberculosis they should begin at the beginning—that was, that the Local Authority should have notice of all cases which happened in the district. That, it seemed to him, was the initial step, and yet how little had been done up to the present in obtaining notification. In the town which was advised by his friend Dr. Niven—Manchester—in the adjacent town of Salford, and in the town of Oldham, and some other Urban districts in that neighbourhood, there was, or had been, some little voluntary notification of tuberculosis; but elsewhere, he believed, practically nothing had been done. As some of them knew, he had tried to obtain compulsory notification in his own county, and he should have succeeded in some of the districts had the Local Government Board consented. However, when resolutions were passed by some District Councils making tuberculosis notifiable, and were forwarded to the Local Government Board for their approval, the Board replied that they were not prepared, at present, to approve of phthisis being added to the infectious diseases required to be notified. In these circumstances they could proceed no further. However, he issued a memorandum of the preventive measures which the County Council advised should be enforced. In some districts these were distributed from house to house; in other cases they were left at houses where it was known that cases of phthisis obtained; and in some districts the memorandum was printed as a poster, and displayed on the walls and the doors of public offices. He was told that the resolutions were not to be varied, but to be voted on as printed. He did not wish to be hypercritical, but the first resolution, instead of reading, as it does here, "that some system of notification of human tuberculosis, at any rate when accompanied by a discharge, is desirable," should, in his view, read "that some system of notification of human tuberculosis, at any rate when pulmonary signs were present, was desirable." We did not want notice given of all kinds of scrofulous diseases. We did not want to know that a man had got a scrofulous ulcer on his thumb. We did not want to know when a child—he had seen such cases in children's hospitals—had got a scrofulous ulcer upon the cornea. It seemed to him that according to this resolution they would obtain notification of cases which it would be quite useless to know of. With reference to the second resolution —"that sanitary authorities should urge the management committees of hospitals, etc., to give preference to farmers who would supply milk from herds guaranteed free from tuberculosis by the tuberculin test"—he was wholly in accord with that, but he feared that so little had been done up to the present time in the use of the tuberculin test that no great results would come of it. The third resolution—namely, "that sanitary authorities should advertise from time to time in local newspapers, lists of farmers who supply milk from herds guaranteed free from tuberculosis by the tuberculin test, in order that private consumers may know where to obtain such milk"—he approved of, but he did not think that these lists would be very long ones. In his own county the list would be complete when two or three names had been entered, and in many counties he believed the blank sheet would be a complete list. As to the fourth resolution, which we may take as read, he was quite in accord with it, and he thought the Government, by giving official evidence that they were satisfied with the tuberculin test, would give a stimulus to the use of tuberculin. It was unfortunate that when Sir George Buchanan's report was issued it appeared to discredit the tuberculin test. As to the fifth resolution, which deals with public abattoirs, he had nothing to say against it. As regards the sixth, which was in favour of compensation to butchers for the carcases of animals condemned for tuberculosis, when these animals had been bought *boná fide* as sound, and before slaughter showed no signs of disease or wasting, it seemed to him that it would have been better if something had been said with regard to the amount of compensation. He quite agreed with Mr. Hunting, that the best form of compensation with regard to tuberculosis should be on the same lines as that which obtains with reference to other infectious diseases in animals.

Dr. J. F. J. SYKES (London) said he did not rise for the purpose of opposing in any way the resolutions, which were very excellent, but he could not help following somewhat on the lines of Dr. Vacher, and pointing out that there were one or two difficulties. Dr. Vacher had suggested that there were some difficulties in the first resolution—the question of notification, for instance, of scrofulous ulcers. He would mention a further difficulty. Medical men are familiar with the enormous number of patients subject to expectoration when the lungs are affected with tuberculosis, and to diarrhœa when the bowels are affected. It is scarcely necessary to point out that under a system of notification such as that proposed, the notification would embrace all those cases of expectoration and diarrhœa in which there was the slightest symptom of tubercular disease. These constitute a very large number indeed. He did not wish to go into details as to how one could get over the difficulty, but it was a question which would have to be very seriously considered. There was another point. We cannot very well treat human beings as roughly as we can treat cattle. But Koch's tuberculin system of injection practically tested human beings who were affected, or were supposed to be affected with tuberculosis, and perhaps some modified form might be adopted. He thought that it might be a desirable thing, if a person had some doubt as to whether he was suffering from tuberculosis, to submit, for his own health's sake, and for the sake of his family, to some process of that kind in order to diagnose what physical examination could not recognise, as there was in the early days of tuberculosis very great difficulty in diagnosis. In respect to resolutions two, three, and four, he did not think there would be any difficulty, but in relation to the fifth, he noticed the words "every district" occur.

THE CHAIRMAN: It means every urban district.

Dr. SYKES said perhaps they might think him captious, but he had always looked at the ultimate aim of meat control not as being a question of every district. He should like to see the cattle, not slaughtered in our towns, but slaughtered where they are bred and reared, and sent to the towns. If one were to establish a slaughter-house in every urban district, we should have such a transport, and such a sending of cattle about the country, that might very well be avoided. The ultimate aim it seemed to him of dealing with cattle for food supplies was to slaughter them, at a remote distance from the towns, and to send them, as dead meat to the towns, and the control could be exercised at the place at which they were slaughtered. The driving of live animals in towns, over roadways, or in railway trucks, and in such other places as it was at present necessary to put them in the course of transport, was not a desirable thing, and so he was rather opposed to the idea of establishing public abattoirs in every *town*. He presumed that, in the sixth resolution, the word compensation was meant to be public compensation. He did not know whether that was so, perhaps it was only a small matter, but the paying of compensation in the case of *bonâ fide* transactions would, he believed, be entirely for the public good.

Prof. OLIVER, M.D. (Newcastle-upon-Tyne) said although he was not a Medical Officer of Health, as a physician he would just like to say with what pleasure he had listened to the papers which had been read, and to the discussion which had followed. He did not think that this matter could be discussed at too great length. He had often wondered why in our large towns the dairies were not registered and inspected, and was therefore very strongly at one with Dr. Woodhead when he said that these dairies should be registered and inspected, con-jointly by the Medical Officer of Health, and a veterinary surgeon, each looking after his own patients. He differed from the Medical Officer for Birkenhead when he spoke as he did of veterinary surgeons. At the present time the veterinary surgeon's knowledge of pathology in a great many instances may not be what it ought, but we must make a beginning at some time or other, and we must therefore, if we are to associate ourselves in the way suggested by Dr. Woodhead and make it our duty to get the best veterinary surgeons we possibly can, get one with a knowledge of modern pathology. We must not forget that it was only within the last few years that the Medical Officer of Health had himself attained to that standard of bacteriological and pathological knowledge which was now required of him, and that years ago men undertook to do the work of Public Health appointments and still did in some places, without any extended knowledge of the pathological problems we are discussing. He agreed with Mr. Hunting's remarks generally. He thought that compulsory notification, so far as animals were concerned was a very good proposition, and the same remark applied to isolation, and to the application of the tuberculin test. His opinion was that whilst the tuberculin test did no harm to animals, it indicated the existence of tubercular disease. He was rather interested in Dr. Scurfield's remarks when he said that nearly thirty per cent. of the post-mortem examinations revealed the existence of tubercular disease. That statement goes hand in hand with others which he had read of, viz., that in a very large dairy the test was made, and from thirty to seventy per cent. of the cattle responded to the tuberculin test. He was struck by the fact that Dr. Woodhead did not give that prominence to hereditary transmission which he (Dr. Oliver) thought was due to it; and also by a remark in Dr. Scurfield's paper where he said that instances of children dying one after another of tubercular disease in a family, must be looked upon as illustrations of infection passing from one to the other. These could not be the conditions in every case. There were many cases where sons or daughters had married and left their homes, and were therefore widely separated from each other, and yet tuberculous disease had presented itself at a particular age, where there had been no association whatever with each other. Such a circumstance was to him an illustration of hereditary influence, not so much causing the disease of itself, as in some way or other rendering the individual more liable to become a prey to the tubercle bacillus. He had listened with interest to the remarks about giving certificates where there were freedom of dairies from tuberculosis, but he thought, with some of the speakers, that it would be perhaps a little rash to do this. There was no doubt that the granting of a certificate, however much it might act as a solace and a comfort to the public, and to consumers in general, would entail considerable responsibility, so that if anything happened, whereby the milk was not quite as it ought to be, there would be a tendency to blame the Medical Officer of Health; he would rather therefore be disposed, for the present at any-rate, to withhold the granting of certificates, much as he, himself a consumer, would like to have the assurance that the cattle of the dairy from where he got milk was healthy. There could be no objection to these recommendations being passed. He did not accept them *in toto*, but he looked upon them simply as recommendations to the Council of the Institute, or as a report going up from this section to the Council, to serve as a basis for discussion and investigation.

Mr. BAILIE DICK (Glasgow) said he should like to know what would be done with these resolutions. What are the Council expected to do with them? Supposing they are passed, what would become of them? He took it that they were all, in a general way, agreed as to the desirability of having such aids as were mentioned in these resolutions, but they were not agreed as to the details. For instance, the first resolution speaks of the desirability of *some* system of notification. Now they ought to know what system they were going to have, and he thought they should ask the Council to devise some system, and submit it to the next Congress, and that the scheme should be one which could be carried out, and the Council should show how it could be carried out. Then as to resolution five, they should have some definite recommendation before them. In the meantime they were agreed as to the principles, and he hoped the Council would carry the matter to a practical issue. He should like to see resolution six better defined, because unless they had some ways and means of checking the amount of compensation, and the claims for compensation, they would be led into a great deal of trouble indeed. Many men would lay themselves out to obtain that compensation, and unless they had a very careful system, it would be a very dangerous thing. They should have that system brought fully before them, and then try to put it into practical work. With regard to public abattoirs he had a great deal of sympathy with the proposal. It would be well to have them in large towns, and they would have to take care that a careful inspection was made of the abattoirs, and persons should not be allowed to send any dead meat from those places dressed up, and all traces of any disease in it taken away. They must ask the Council to consider these matters, and to bring up a report with recommendations as to how to turn these resolutions into practical methods.

THE CHAIRMAN said he should like to explain the method of procedure which would be carried out. The Council of the Institute always gave recommendations of this kind their very careful consideration. As a general rule a Committee was appointed, consisting of a number of gentlemen mostly experienced in the particular subject in hand, and they proposed any alterations they thought desirable

Their report then came before the Council, who considered the matter for a second time. Their decisions were sent to the Congress next held and were also published in the "Journal." Any action that the Council thought necessary or desirable was taken.

Dr. **Alfred Hill** (Birmingham) said he had no criticism to make of the matters under discussion, as on most points he was agreed. But there was just one question he should like to ask Mr. Hunting, as to a statement of his which he did not understand. He said in his remarks that "advanced cases would be immediately slaughtered. The rest would be isolated until such time as they were fit to be killed for trade purposes." What were trade purposes? Was it supposed that these animals were going to get well, or was it that their skin or other parts are to be used for trade purposes? It was very obscure, and he should like an explanation.

Dr. **Malcolmson** (Middlesborough) said in the main he agreed with the recommendations that were submitted, but was sorry that they were, so to speak, thrown at them so that the collective wisdom of that meeting could not be allowed to improve them if they thought it necessary. In the main, he repeated, he agreed with them, but there were one or two points that he thought they should have considerable difficulty with when trying to urge along these recommendations. One difficulty was in resolution number five. The difficulty that arose when you proposed to make a public abattoir and compelled everybody to slaughter their animals there, was, what was to be done with the present vested interests that had been established under the licenses of our present presiding authorities? How could that difficulty be got over, because the property which was at present being used was often very valuable, and in many towns £700 a piece would not be over stating the value, and the owners of that property ought to be compensated in some way. Where that compensation was to be got he did not know. At present the law would not close a slaughter-house unless it was a nuisance. Technically he should call it a nuisance, but he did not suppose he could prove that to the Magistrates. Then again he thought the sixth resolution would be somewhat difficult. It stated that compensation should be given to butchers. Now he thought that compensation should not be limited to butchers. Those cases ought to be dealt with before they reached the butcher if possible. He knew butchers who made it a trade to buy these cattle, knowing that there were a certain number diseased, and they took the chance of getting them past the Inspector. Giving these men a third of the value of detected animals would be giving them a third more than they at present get. He would say, compensate the bonâ fide owner of an animal that had got disease which we could now diagnose, but which could not be diagnosed by himself.

Mr. W. **Hunting** (London) said that first of all he should like to refer to Dr. Marsden's difference of opinion with Dr. Woodhead's statement that the veterinary surgeon was the fit and proper person to inspect meat. Really there was very little practical difference between the two gentlemen. Dr. Marsden thought there were some veterinary surgeons who were not properly educated. Well, there were some bishops, and some medical officers in the same fix. He would point out that though his unfortunate profession had obtained an Act of Parliament prohibiting outside people using their name, yet they had had to tack on to their Register three thousand men who were legally entitled to call themselves Veterinary Surgeons, but who never went to college. Perhaps Dr. Marsden referred to some of these. But Dr. Marsden pretty nearly stultified himself by expressing the opinion that a good butcher was a very good meat inspector, and could do all that was required. That did away with the medical officer and the veterinary surgeon both. Then Dr. Marsden thought that the scheme of compensating the butcher proposed in the paper was not a good one, and naturally thought his own scheme was a very good one, in which he suggested that three different parties should contribute to it. He said, "If it was difficult to get one-third paid, surely it was as difficult to get one-fourth." Nobody said it would not be! The scheme suggested by Dr. Marsden had three contributors; his only one—the local authority. Adopting the principle of "The Sale of Goods Act," and making the seller responsible for the sale, he thought covered the whole thing. It left the farmer and the butcher to arrange the compensation for themselves, and at the same time made an automatic detective of the butcher, and protected the public, because it did away with the only possible reason that a seller could have for disposing of a tuberculous animal—that was, making money of it. Councillor Willock referred, in the course of his remarks, to the fact that the meat inspector in Glasgow was a policeman. The metropolis was even worse off. For he saw by a recent publication of Parliamentary papers what the sanitary inspectors were before they obtained those positions. They were selected from gas-fitters, school-masters, naval officers, and various other trades, absolutely and utterly ignorant of either meat or milk inspection. Dr. Oliver said that the veterinary surgeon was not altogether the proper man for the inspection of cattle, because many of them were not pathologists. It was quite true, and he would add that many doctors were not pathologists.

Professor OLIVER observed that what he said was that the opprobrium that was attached to the veterinary surgeon a few years ago was gradually disappearing.

Mr. HUNTING said they did not desire to be pathologists, they only wanted the results of their work. He looked upon pathology as a special branch, just as is chemistry, and he believed that pathological or chemical researches should be entrusted to specialists. As to heredity as an influence in the spread of tuberculosis, Dr. Oliver was surpised that it had been denied. He was utterly astonished that anyone could imagine that heredity had anything to do with it. Before Koch's time hereditary influence was invented as a theory to account for something that could not be understood. Immediately upon the discovery of a specific cause—a definite bacillus—the theory of heredity was knocked on the head, and the burden of proof was now entirely on those who imagine it had any existence. His statement that animals which had reacted to tuberculin should be separated from the healthy stock and kept until ready "for trade purposes," had been referred to by Dr. Hill. What was meant was this: there were some cases of tuberculosis indicated by the reaction of tuberculin which were perfectly fit to be used for human food. There were other cases in which it was perfectly safe to breed from an animal suffering from tuberculosis. The experiments of Professor Bang showed that out of a large number of calves born of distinctly tuberculous cows, hardly any developed the disease when guarded from infection and contagion. The two "trade purposes" he referred to were the production of meat, and the use of animals for breeding purposes under careful isolation. Dr. Malcolmson thought that compensation should not be given to butchers because it might lead to fraud, and that it would pay them to deal in disease and obtain compensation. He did not think so. Immediately they found any trace of disease in animals the source from which they came could be detected, and by giving compensation they would facilitate all measures of control or suppression. Newcastle would then be able to trace the source of disease in those tuberculous animals which came into the market from the neighbourhood of Dumfries. Immediately they gave compensation they prevented fraud; they did away with the reason for the fraud—that was, making money.

Dr. SCURFIELD (Sunderland) said, with reference to what Dr. Vacher had said as to the Sanitary Authorities not being able to find herds that were guaranteed free from tuberculosis, he did not expect that they would find many, but it was to enable them to find these herds that he proposed the resolutions which dealt with that matter. One must offer an inducement to the farmer to use the tuberculin test, and he thought a great many members of the community would be willing to pay an extra price for such milk, and thereby compensate the farmer for the trouble he had been put to. With regard to Dr. Marsden's objection to certificates: if a farmer tested the whole of his herd with tuberculin and gradually got rid, as he best could, of any animals which reacted, he would put himself to an immense amount of trouble and expense; was that farmer going to be such a fool as not to test the new animals which he subsequently bought? With regard to Dr. Sykes and Dr. Vacher's remarks about the patients with scrofulous sores and discharges, he thought that patients that suffered from tuberculous joint disease with a discharge should be amongst those notified. He thought a discharge from a tuberculous joint should be notified as well as an expectoration. With regard to scrofulous ulcers, he did not think that it was likely that the general practitioner would notify such a trifling thing, as, for instance, phlyctenular conjunctivitis. He spoke as having been a general practitioner, and he did not think he should like to notify anything that could not justifiably be called tubercular. He did not think he would put his patients, without due cause, to the inevitable annoyance of notification, and most people looked upon it as to a certain extent a stigma or disgrace to have a case of tuberculosis in the family. In many cases the practitioner would be more inclined not to notify in order to spare the feelings of those he was attending. With reference to what Dr. Oliver said about heredity, he thought that it was now pretty well recognised and all the principal authoritiies seemed to agree—for instance, MacFadyean, Woodhead, Koch, Bang, and Nocard —that it was a rare thing for the inheritance of the bacillus to occur. Such a thing could happen. Bang, in the whole of his career up to last summer, had met twenty-eight cases of inherited bovine tuberculosis, inclusive of miscarriages and calves born dead. Woodhead mentioned in his paper the conditions under which the baccili may pass from the mother to the fœtus in utero, namely, that there must be a generalised tuberculosis of the mother or an affection of her uro-genital organs. Unless there had been one of these things, the passage of bacilli from mother to fœtus could not take place, and a mother so affected, at any rate in the case of cattle, did not usually carry the fœtus to the full time. With reference to what Dr. Oliver said about predisposition, he thought the fact that some people were born with a predisposition to phthisis made it all the more necessary that precautions should be taken to protect everybody, especially as we had no means of knowing who had got and who had not got the predisposition. If we knew that people were born free from the baccillus then every case of the disease must be due to infection.

The resolutions were then put to the meeting and carried with two dissentients.

The President of the Section (Professor Corfield) rose to propose—"That this Section of the Congress of the Sanitary Institute is of opinion that the Board of Guardians have proved themselves to be entirely inefficient bodies to be intrusted with the administration of the Vaccination Acts, and recommends the Council to commend to the attention of the Government, the advisability of entrusting the administration of these Acts to some other authority." He said notice was previously given of this motion, after a discussion on small-pox. He did not think it would be necessary to hold a discussion on the motion. He wished, however, to make one or two remarks of the nature rather of a personal explanation with regard to this matter. He had been asked whether in his address he intended to include those Medical men—some of whom are of undoubted ability—who are opponents of vaccination, or opponents of compulsory vaccination, in a remark he made; and in what category he should place them. In that address he referred to the opponents of vaccination as either ignorant persons or interested agitators. He could not imagine anything more advantageous to the pockets of the medical profession for a great many years to come, than the abolition of compulsory vaccination would be; and he had always held that it was to the highest credit of the medical profession that they had supported compulsory vaccination—the side which was entirely against their own interest. Therefore he included them, if anywhere, under the heading of ignorant persons. There were two kinds of ignorance:—simple ignorance, which was the ignorance of the person who did not know the facts of the case, and who was aware that he did not know them. That was simple ignorance, like the ignorance for instance of a labourer on a farm, who knew nothing about chemical analysis and who knew that he was ignorant of it. Then there was compound ignorance, which was the ignorance of a person who was ignorant of the subject, or of the true conclusions to be drawn from the facts, and was unaware of the fact that he was so ignorant. The opponents of vaccination were the possessors of that kind of ignorance. They were for the most part ignorant of the main facts and of the true conclusions drawn from these facts by the general body of the profession, and they ignored the fact that they were ignorant. That was their fault. But he would say still that there were a certain number of gentlemen who were exceedingly able men, men high up in the profession, certainly very able men, and men who had written very important treatises on this and other subjects who were ignorant; and they were ignorant for the following reason—they were unable to deduce from the facts the only conclusion warranted by those facts, and the reason was this: that there were two kinds of methods of argument, deductive and inductive: compulsory vaccination was supported by the most powerful inductive argument that had ever been brought to bear upon any fact known to the medical profession. It was acknowledged by the medical profession and by the governments throughout the civilised world. There were a certain number of minds, and some in the medical profession, that were incapable of appreciating the force of inductive argument. They must have everything shown by deductive arguments, and those eminent gentlemen to whom he referred were in that predicament. They were totally unable to appreciate the force of the most powerful inductive argument that had ever been brought to bear upon any fact in the history of medicine. They were therefore incapable of drawing the true conclusion from the facts they had studied, and must therefore remain in the ranks of the ignorant.

The resolution was agreed to.

On "*Some of the Vital and Mortal Statistics of Dublin*," *by* Sir Charles A. Cameron, Superintendent Medical Officer of Health, Dublin.

The mean death-rate of the Irish towns is decidedly greater than that of the English towns. On the other hand the rural death-rate in Ireland is below that of England. Dublin formerly had general and zymotic death-rates considerably above those of the other Irish towns, taken together. Lately, however, the Dublin death-rate from all causes has almost completely come down to that of the Irish towns, whilst its zymotic death-rate has fallen below that of the other towns.

Some years ago the state of public health in Dublin was very bad, but it has improved considerably during the last decade. A few figures will show how great the improvement has been.

Years.	Death-rate from all causes per 1000 persons living.	Zymotic Death-rate.
1876—1880	29·5	5·1
1881—1885	27·4	3·1
1886—1890	26·8	2·9
1891—1895	26·1	2·3
First half of 1896	23·4	1·2

Thus it will be seen that whilst there has been a substantial reduction in the general death-rate, the mortality caused by the principal zymotic diseases has been reduced more than one-half in the five years ended in 1895, as compared with the semi-decade 1875-80. The Dublin death-rate is still decidedly higher than that of the English towns, but as regards the zymotic death-rate Dublin now shews a slight superiority. Thus the rate in the thirty-three largest towns* in the five years ended in 1895, was 2·7 per 1000, whilst in Dublin it was 2·3. In the first half of 1896, the zymotic death-rate in the thirty-three largest English towns was 2·8, and in Dublin only 1·2.

The decline in the zymotic death-rate in Dublin is very much greater than in the English towns. As will be seen by the following figures:—Periods 1876-80, 3·8, 1881-85, 3·3, 1886-90, 2·9, 1891-95, 2·3. First half of 1896, 2·8.

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* I have recalculated the rates, between 1882-1891, on the basis of actual population ascertained by the census of 1891, the figures annually published in that period being based on estimates of population.

Zymotic Death-rate, Five Years ended 1895.

Locality.	1891.	1892.	1893.	1894.	1895.	Mean Rate, 5 Years.
Dublin (whole area)…………	1·7	2·9	3·1	2·1	1·9	2·3
Belfast ………………………	2·6	3·8	4·7	4·1	3·3	3·7
Thirty-three large towns in England ……………	2·84	2·44	3·18	2·64	2·42	2·7

Death-rate in Dublin (whole area) during Five Years ended 1895.

	1891.	1892.	1893.	1894.	1895.	Mean Rate, 5 Years.
Dublin (whole area)…………	25·5	28·4	26·0	23·8	27·0	26·1

Death-rate in Belfast during Five Years ended 1895.

	1891.	1892.	1893.	1894.	1895.	Mean Rate, 5 Years.
Belfast ………………………	25·2	26·5	25·8	24·6	26·2	25·7

The infantile death-rate was formerly very high in Dublin, but for some years past it has differed but little from the mean rate in the great English towns as regards the relation between the deaths and births. The ratio of deaths of children under one year of age to deaths of persons of all ages is, however, very different in the English towns as compared with Dublin.

Death-rate of Children under One Year of Age in 1894 *and* 1895.

	A England and Wales.		Twenty-three Largest English Towns.		London.		Dublin.	
	1894	1895	1894	1895	1894	1895	1894	1895
Per 1000 of the estimated population under one year of age…	136	162	151	183	143	166	151	171
Per 1000 of the estimated population of all ages………………	4·1	4·9	4·7	5·7	4·3	5·0	4·3	4·9
Per 1000 births registered ………	137	161	152	182	143	166	152	171
Per 1000 deaths registered ………	245	261	259	276	243	255	152	176

Without claiming that the great reduction in the Dublin zymotic death-rate is chiefly due to the sanitary reforms which have been carried out during the last sixteen years, it seems only reasonable to infer that these reforms have to some extent contributed to bring about that happy state of things. The chief improvements effected in Dublin during the time referred to are as follows:—Two extensive insanitary areas have been cleared, and nearly 2,000 insanitary dwellings have been closed. The scavenging of the yards and sanitary accommodation of the tenement houses has been established. The domestic scavenging clause of the Public Health Act has been put in force. Two open spaces have been formed, and contributions towards three open spaces not in charge of the corporation have been made. An abattoir and baths and wash-houses have been erected.

Large sums have been expended in improving the roads, paths, and sewers. There has been a large increase made in the sanitary staff, and the inspection of tenements, factories, and workshops, is now vigorously carried on. Loans amounting to £136,000 have been or are being expended in the erection of artisans' dwellings. Disinfection is free to everyone. The best forms of ambulances for the conveyance of fever patients to hospital have been adopted. A great scheme of main drainage will soon be in use and will be probably the last great sanitary reform needed, with the exception of improved hospital accommodation for fever patients. Dublin is by no means a rich city, but has expended the following large amounts on sanitary improvements:—

Sanitary Loans Account, Public Health (Ireland) Act, 1878.

Statement of loans sanctioned or inquired into to 30th June, 1896:—

	£	s.	d.
Clearance of Unhealthy areas:			
Plunket Street Area	31,919	0	0
Coombe Area	25,960	0	0
Erection of Artisans' and Labourers' Dwellings	141,296	0	0
Sewer Works	44,900	0	0
Pumping Stations (pumping up sewage to prevent undue accumulation of sewage in sewers)	16,707	1	7
Construction of Abattoir	16,200	0	0
Making new Streets by clearing away narrow courts, &c.	157,700	0	0
Private Improvement Expenses	9,500	0	0
Urinals, Latrines and Underground Conveniences	2,900	0	0

	£	s.	d.
Works in connection with domestic and other scavenging operations	33,225	0	0
Erection of Baths and Wash-houses	12,500	0	0
Open Spaces	1,600	0	0
Structural Alterations at Disinfecting House	2,000	0	0
Erection of Refuge for persons whose dwellings are being disinfected	500	0	0
Mortuary	200	0	0
	£497,107	1	7

Average Annual Cost of Sanitary Department, £4,533 3s. 4d.

Large sums have also been expended on Improved Paving (£345,305), Erection of Sanitary Offices, &c., Improved Markets, &c.

The President of the Section (Professor Corfield) said the Section was very much indebted to Sir Charles Cameron for his exceedingly interesting paper, and would congratulate him on the excellent results produced in the health of the city of Dublin by his work for the past twenty-nine years, during which time he had been the Medical Officer of Health. The paper was a paper of statistics, and he remembered that an eminent countryman of Sir Charles Cameron's said in his hearing, on a certain occasion, that he always looked upon statistics with some amount of suspicion; he thought they were like sausages, because "you ought to know the young woman that made them." They knew who made these statistics and so they knew that they were correct, and they would congratulate Sir Charles Cameron upon them.

Sir Charles Cameron, in answer to a question, said that the death rate in Dublin was calculated in the usual way—the number of deaths per thousand of the people; and the deaths in institutions of persons remitted from country districts were eliminated. The calculation is made on a population of 349,000.

Dr. Charles Porter (Stockport) asked Sir Charles Cameron how the question of the disposal of excrement had been met.

Sir Charles Cameron replied that as soon as he got the power into his hands he at once tried to get rid of every permanent storehouse of excreta in the city. He went in for the water carriage of filth, and now almost every tenemented house in Dublin had that method of sewage removal.

Dr. **Garrett** (Cheltenham) asked Sir Charles Cameron whether they had any difficulty in Dublin as to the action of water on lead.

Sir **Charles Cameron** replied that they use an alloy that he devised, and which had been found not to be acted upon. It was composed of 96½ parts of lead and 3½ parts of tin, and was the only metal that could be legally used in Dublin according to the waterworks by-laws. He devised it especially for the Dublin water after some experiments he had made, and they had never had a case of lead poisoning in Dublin since.

"*Infantile Mortality of Large Towns*," *by* H. O. Pilkington, M.R.C.S., L.S.A.

Abstract.

Importance of subject is shown by the fact that during the past ten years the infantile mortality (as estimated by the number of deaths under the age of twelve months to each thousand births), has been for the whole of England and Wales 142, for the large towns 169, and for Preston, always remarkable for its high infantile death-rate, not less than 232.

Some of the causes which bring about this loss of infantile life prevail in most of the large manufacturing towns, and it is because they are found in combination in Preston that this town has acquired its unfortunate reputation.

Since the causes are varied and numerous, no one remedy can be devised to meet them all, but each must be met and fought upon its own ground.

First amongst these causes is the employment of female labour in the mills. If an occupation, which requires a woman to stand during the greater part of the day, be followed up to within a few days or even hours of the time of parturition, it must act to the detriment of the offspring, and there is less chance of the latter coming into the world, fully grown, well formed, and in good health.

Many deaths taking place during the first month, and which are returned as due to premature birth, immaturity, congenital debility, convulsions, and the like, may safely be ascribed to this cause.

The return of the mother to her work within a very short period after confinement, thus depriving the infant of a mother's care, and of the sustenance which nature intended it should have, constitutes even a still greater evil. And with this is connected the nursing out of infants, and their exposure to violent and sudden changes of temperature during their removal night and morning through the cold air of the streets.

But a third and more important cause consists in the very habits of the operative classes themselves, in their ignorance of the first laws of health, and in their blind adherence to customs which have long since been deservedly condemned. In the older manufacturing towns where there is little importation of fresh blood from without, there is a risk in the inter-marriages (often early marriages) amongst persons of the same class, and a danger of the progeny becoming more and more enfeebled.

There are few people with less knowledge or experience of household duties than the ordinary factory girl, and as a consequence she becomes a wife and a mother knowing little of the duties required of her, and content, as regards the management of her children, to follow the example of her parents and the customs of those amongst whom she lives. Accustomed to a heated atmosphere, the factory operative above all things fears a draught, and so the doors, windows, and fireplaces of the sleeping chamber are kept closed; its cubical capacity is often tested up to, and often above, the proper limit, and in this way the seeds of tubercular and scrofulous disease are engendered, and transmitted from one member of the family to another.

Unwholesome food and the want of cleanliness in its preparation and administration, are the direct causes of many infantile deaths. Bread and starchy preparations are substituted for milk, and where the latter is given, the feeding bottle from its dirty condition, frequently forms a source of danger to the infant's life. After the first week or two, proper and systematic ablution is less and less frequently used, fresh air and sunlight are not recognised as necessary requirements, and altogether there is a want of proper *nursing*, a word pregnant with meaning as applied to infantile life.

In the older manufacturing towns the houses of the poorer classes are crowded together, and the yards are small, badly paved, and largely taken up by the privy and ashpit.

To these conditions are due Infantile Summer Diarrhœa, which in certain parts of Preston at any rate, may with certainty be predicted after the ground temperature at a depth of four feet has reached to a height of 56 degrees.

Amongst other causes must be mentioned that of Insurance, by which the death of a child brings a monetary gain to the parents; the habit of allowing very young children to sleep in the same bed with their parents, resulting in deaths from suffocation, or "overlaying"; and the use of sleeping stuffs to quiet a fractious child, or to ensure a good night's sleep.

These, then, are the causes which sometimes separately, but more frequently in combination, lead to the heavy death-rate amongst infants in our large towns and cities.

As regards remedies, the Medical Officer of Health can close all houses or cellars unfit for habitation, enforce the removal of all nuisances from the neighbourhood of dwellings, and require the conversion of dangerous privies and ash-pits into some simple form of water-closet and *ash-pail*. He can keep the subject of Hygiene constantly before the public, and in times of special danger can issue short instructions to parents. Legislation might do something more to control female employment, but regulations too stringent or exacting would only be evaded or broken. Crêches or Day Nurseries in connection with the mill might do much good, but they must be self-supporting, without entailing much trouble or expense upon the mothers. Insurance, being a provident measure, deserves encouragement, but requires restrictions both as to amount, and the age at which a child becomes payable. A closer scrutiny should be made in cases of uncertified death, and this could be done by a Medical Adviser to each Coroner, whose duty would be to make enquiry into the circumstances of such deaths, and to decide whether or not a more searching investigation was required.

But Education, whether that given by the Medical Officer of Health, or that received by the rising generation in our Schools, is the remedy to which we must look. Year by year the working-man is taking more interest in matters connected with Public Health, and is beginning to see the loss involved by sickness and death, and to recognize the fact that an infant, like a plant, requires fresh air, pure water, and sunlight.

Dr. **Alfred Hill** (Birmingham) said, with regard to the question of infantile mortality, that there were some towns which suffered very much more than others, and especially in the matter of deaths from diarrhœa. Preston had the unenviable reputation of having the largest death-rate of infants from this cause. He should be glad to hear from Dr. Pilkington if he could give any information as to the very high mortality from the disease in Preston.

The Hon. **Rollo Russell** (Haslemere) said he should like to ask Dr. Pilkington if he could account for the very large differences between the infant death-rates in certain Model Dwellings, and in the general population of a town. In the buildings of the Metropolitan Association, for instance, the infant death-rate was, per 1000 births, 113 in 1893, 136 in 1894, 110 in 1895, compared with 164, 143, and 166 in the rest of London.

Dr. **Garrett** (Cheltenham) mentioned the case of a small village fifteen miles up the Tyne, called Corbridge, where, as Dr. Armstrong stated some years ago, there had not been a death under one year for many years. The infantile death-rate of Cheltenham was between this extreme instance and that quoted by Dr. Pilkington. Dr. Pilkington had given some very interesting particulars in the *resumé* of his paper, but he had not told them why the infantile death-rate varied so much in towns of similar character. Why, for instance, was the infantile death-rate of Oldham and other mill places in Lancashire less than that of Preston?

Dr. **Pilkington** (Preston) said he thought it probable that had he read the whole of his paper the questions which had been put to him would have been answered. The reason why the infantile death-rate in Preston was so much higher than the infantile death-rate in Bolton, Blackburn and neighbouring towns, and why the diarrhœal death-rate was so much heavier, was because all the causes work in combination in Preston. It was one of the oldest manufacturing towns in Lancashire. There were more females employed in the mills there than in other towns. The houses in the older part of the town had all the disadvantages, being crowded together, whilst the yards, lobbies, &c., were imperfectly paved. Until lately a great part of the town was provided only with the old-fashioned privies and midden ash-pits. These were now being gradually abolished. In many parts of the town they were entirely done away with, the ash-pits having been filled up, and the privies converted into water-closets, so that although the nuisance had not altogether been removed, the state of things was very much improved. But, he repeated, it was because in Preston all those causes of evil (present more or less in most manufacturing towns) had been working in combination that Preston until lately had occupied the unenviable position which it had amongst the large towns of the kingdom. There had been a great improvement lately, and when further contemplated alterations were carried out, a still greater improvement might be looked for in that town.

"*The Bacterial Filtration of Public Water Supplies*," *by* WOLF DEFRIES, B.A., M.I.Mech.E.

(MEMBER.)

THE term "bacterial filter" is used sometimes to denote a filter such as a sand filter, which delays the passage of organisms to a greater or less extent, varying with the nature and thickness of the filtering medium, and the velocity of the water. Broadly the action of such filtration depends on the fact that the organisms pass less freely through the minute channels of the filter than does the water, and accordingly take a longer time to be washed through. During this time some, but not all, of them probably perish. The delay is to a large extent dependent on the formation of a film of slime on the surface. In practice such filters do not ever remove all the organisms contained in the water; but at their maximum efficiency they remove an extremely large percentage. The extent of their efficiency in this respect can only be tested by bacteriological examination of the filtrate itself; and the time and the nature of the attention which they require to restore their efficiency, when from time to time it is decreased below what is regarded as satisfactory, involve both judgment and skill to obtain the best result of which the filter is capable. Filters of this type usually remove some part of the dissolved constituents of the water; but the filtrate may nevertheless remain as capable as the unfiltered water of permitting the growth of pathogenic micro-organisms.

In this paper I do not propose to apply the term "bacterial filter" to such filters, but to reserve it for those which arrest the whole of the organisms contained in water on the surface of the filtering medium, irrespective of the thickness of the medium and of the velocity or pressure at which the water is delivered; and my purpose is mainly to suggest in general terms some conditions which are absolutely indispensable for such filters when applied to public water supplies.

The means at present available for bacterial filtration consist in the use of porous materials of definite composition which are empirically found to have the property of arresting organisms; something like a porous magnet would do with water containing little iron specks. It is necessary that the filtering bodies of this material should possess mechanical strength, seeing that pressure can be applied without detriment to their filtering capacity. At the same time it is desirable that these bodies should be as thin as possible, so as to offer the least obstruction to the passage of the water, and therefore to permit the greatest output for a given filtering area. The form which in practice gives the greatest mechanical strength is that of a cylinder. The smaller the diameter of that cylinder, the thinner its walls may be to stand a given pressure. As, therefore, the diameter of such cylinders is enlarged, and the filtering area, and consequently the output, increased, it becomes necessary in order to maintain the mechanical strength to increase the thickness of the tubes, and to that extent to diminish the advantage in point of output which is obtained from the increased diameter. There accordingly arrives a limit, which in practice is fairly small, on which an increased diameter gives no advantage in respect of output. Bacterial filters, therefore, for public supplies, or for any purpose involving a large output, must be made of a large number of cylinders or tubes. The total filtering area is very much less than is required in the case of sand filters, and the number of joints in the diaphragm separating filtered from unfiltered water, through which the filtering cylinders are inserted, is very much less than the number of points at which a fault is liable to occur in a sand filter. Both this area and the number of joints are nevertheless large for a large supply; and the first condition of the efficiency of a bacterial filter is that it should be capable at any time of a rapid and direct test, both as to the bacterial soundness of its filtering surface, and as to the mechanical soundness of the whole of its joints. By a direct test I do not mean the direct bacteriological examination of samples, during the incubation of which the filters are delivering their filtrate into the general supply. If the filter is defective, such examination may amount merely to a post-mortem diagnosis, and serious mischief may in the meantime have occurred. What is required is a test capable of controlling the efficiency of the filter before it is used.

The second condition which I suggest, which follows from the first, is that the filtering medium must be unaffected by any accidents which can occur to it between occasions of testing. For instance, if it were possible in practice to float a quantity of fine germ-proof material on to a coarser surface, the film would have to be so arranged that no variations of speed which could occur in the crude water, and no small solid particles which it could carry, would be capable of disarranging the film, so as to give rise to bacterial faults.

On the ground of economy it is desirable that the filtering medium should not be altered in its sterilising capacity, either by continuous use, or by repeated cleaning and sterilising. If, however, such alteration be liable to occur, the material must be such that it is possible to determine a period within which filtration can at any age of the filtering medium proceed without risk of affecting its bacterial soundness. The test referred to in the first condition must then be applied within such period, and after every cleaning.

For practical purposes it is of the highest importance that there should be a convenient method of cleaning. The cleaning of bacterial filters involves the removal of the bacteria and other solid substances which have been deposited on the filtering bodies, the sterilising of those which adhere to the surface too strongly to be removed, and the removal of the substances which, probably by dialysis or some allied process, are deposited from the water in the pores of the filter. The best means of cleaning large filters cannot be inferred from that which is adopted with smaller appliances. The practice with small filters has naturally been to attach most importance to the rapid removal of the visible deposit which can be mechanically removed. This is, no doubt, a very desirable thing in the case of filters which are not large enough to occupy the whole time of a man. The attention which such filters receive is more or less grudgingly squeezed out of the day's work of a man having other occupations. A great many attempts have indeed been made to effect the removal of such matters by some automatic arrangement. These attempts are for the most part based on the various constructions of the French engineer André. For instance "Y" shaped rubbers were caused to revolve between concentric rows of filter-tubes, and at the same time to rise and fall, thus removing the visible deposit from the tubes. André employed also several jets of filtered or unfiltered water to more thoroughly wash off the deposit which had been disturbed by the rubbers. He also proposed the use of backward filtration. To still further facilitate the automatic cleaning he proposed, and used in the same apparatus, the plan of depositing kieselguhr on the tubes before any filtration took place, so that the deposit from the water was arrested by the easily removable kieselguhr sheath. The results have been broadly that up to a limit of size, and of frequency of use, a satisfactory arrangement can be made. With continuous use, however, the rubbers are apt to wear out, and when large filters are in question, it becomes a matter of some structural difficulty to assure the accuracy of their position in regard to the rows of filter-tubes, and hence their uniform rubbing on the surface. This would not have been serious if the kieselguhr process had proved to be convenient on a large scale. It was found however, that apart from the bulk of the material to be handled, it was difficult to ensure the uniform deposit of the kieselguhr over a large battery of tubes. The process of backward filtration also required the tubes to be placed with the open end upwards, so as to allow escape of air and entrance of the water to be filtered. This was objectionable, because it prevented the convenient use of solvents for the matters in the pores, unless the cells could be turned over for the purpose of cleaning, and then turned back to allow the solvent to run out and the normal filtration to be resumed; a process which is of course inconvenient for large cells. It will be remarked that in the description which I have given of the automatic method of

André, which includes something corresponding to each of the means suggested by other inventors, the main object appears to have been the removal of the visible deposit. The reason is probably that in the applications of smaller filters it is seldom that the full maximum output is required, or that the filter works continuously. When, however, as in the case of a public supply, the filter is used continuously, it is found that the decrease in output due to the deposit of material sufficiently gross to be visible to the naked eye, is in most cases considerably less than that due to the deposit which occurs in the pores. However perfect a system for the mechanical removal of visible deposit might be, its application would still leave the filter exposed to the reduction of output determined by the internal deposit which is not affected by the mechanical means.

It is therefore an essential condition of convenient cleaning that some solvent should be available which will remove this deposit without affecting the sterilising capacity of the tubes. A system of cleaning which depends mainly on this process has the advantage of at the same time removing similar matters from the interstices of the deposit itself; and this deposit may accordingly form a sort of rough filter, by which with many waters the reduction of output is retarded, and consequently the periods between application of the solvent increased. Regard being had to the fact that organisms arrested on the outside of filter tubes do not necessarily die, it is convenient and desirable that this solvent should also sterilise the filtering system. For almost all waters a five to ten per cent. solution of hydrochloric acid is a suitable sterilising solvent. With bacterial filters of the standard type this means that after the solvent has been run off from the cell or group of cells under treatment, the amount of solvent left in pores and on the surface of the pipes would for most waters not exceed some five minims of acids per gallon of daily output, less so much as may be decomposed by salts in the water. Where, therefore, anything like a day's output is considered it is unnecessary even to rinse the filter after cleaning; but in the absence of storage of filtered water the necessary dilution can be readily obtained by allowing the water to run off for a short time. For the purpose of a large installation it is easy to provide arrangements permitting any cell or group of cells to be cut out of action for cleaning without interfering with the remainder; and the amount of labour which with standard tubes is involved in the necessary attendance to the filter may be taken on the average at a foreman and six assistants for an installation of 3,000,000 gallons per day.

I have entered somewhat into detail in regard to this question of cleaning, and of the labour which it entails, because it is obviously useless to submit as an essential condition any requirements which cannot in practice be realised. Those who are acquainted with the results which have been obtained in late years in the filtration of bacteria will be aware that the conditions of capability of being tested, permanence of filtering medium, and resistance to cleaning and sterilising processes can be obtained without any trouble at all. A practicable and convenient method of cleaning and sterilising on a large scale being now available, the essential conditions of strict bacterial filtration can therefore be conveniently realised in practice. This is the more satisfactory because the method, being independent of the velocity or pressure of the water, enables a far more rapid delivery to be obtained than is possible with any ordinary means of filtration. The filtering area which is required, for example, with sand filters varies according to the different authorities, but it would not on modern practice be reckoned at less than ·75 of an acre per million gallons of daily output, and in some cases as much as 1·25 acres for the same quantity is employed. The area of a filter with standard bacterial tubes varies from about ·075 of an acre to about ·14 of an acre according to the method of applying the pressure and the quantity of the water; and these figures can be reduced by one half or a larger fraction, if it be necessary, by stacking the filter cells. Accordingly it is the fact, perhaps not realised till quite recent years, that strict bacterial filtration on whatever scale yields an output many times as great as can be obtained from any ordinary filter in the same time.

I am far from under-rating the enormous service which has been rendered to public health by the sand filtration of public supplies. It is, however, no less certain that such filters are liable to fail at times more or less uncertain. Even in London I suppose every one has come across examples of very strange objects, leeches and the like, being found in the filtered-water.* Mr. Shirley Murphy's report for 1894 gave, at least, very grave grounds for suspicion that a mild but uniformly diffused epidemic of typhoid fever was during three weeks of that year distributed over the population which were served by those companies which drew their water from the Thames and the Lee. The same experience has repeatedly occurred in Germany, even with sand filters of the best construction. Dr. Fränkel who in the absence of bacterial filters has held the view that "the best means of purifying water is the imperfect means of sand-filtration," gives a striking instance on a large scale. The total number of sand filters in Germany is under three dozen. The occurrences of cholera in Germany in recent years were strictly limited both in time and space, so that only a small fraction of the sand filters can have had to resist the disease. Yet out of these no less than four passed the cholera organisms. Among these was that of Altona, which had previously prevented an outbreak, and Dr. Fränkel points to it as a remarkable example of the fact that "sand filters, even in the hands of the most able and experienced technical experts, are exceptionally sensitive and untrustworthy devices, of which the performance may remain defective in spite of the observance of all possible precautions." It seems probable from works which have already been carried out, and from the tendency of the most competent opinion of the present time, to expect the use of bacterial filtration which has already begun to be followed by a rapid extension. I have ventured to define what appeared to me the essential conditions for filtration of this kind, because the advantage to public health or to public security of its adoption will depend largely on whether these conditions are fulfilled. If they are not, the gain which could be derived from bacterial filtration will be compromised or lost, and the system will run a risk of becoming discredited. If on the other hand they are insisted on with the exactness that is warranted by the importance of the subject, the experience which is already available shows, beyond question, that a very important gain must result.

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* The above statement was written before the writer was aware of the results obtained by Dr. Klein, Mr. Dibdin and others, which give numerous instances of such occurrences.

In conclusion, there is one point which must always be remembered in dealing with any scheme of filtration, and that is that such purification in no way prevents contamination due to faulty reservoirs, leaky pipes, or improperly-arranged closets. I am aware than when filtered water is found to have been contaminated, it is more often traced to a breakdown of sand filters than to local contamination, especially in the case of the more serious epidemics. This circumstance appears to me perfectly good as a reason for substituting bacterial filters proper for sand filters; but it in no way alters the fact that at the time at which filtration plant is put down the distribution system must be carefully overhauled, and both be, and be kept sound. It is a good sanitary axiom that filtration must take place at the last point at which contamination can occur. The ideal arrangement is to dispense altogether with waterworks filtration, and cause every person to have a bacterial filter in his own house. We must all regret, I certainly do, that this state of things represents a counsel of perfection which is never likely to be attained. It is therefore all the more the business of the sanitary authority controlling the water-supply to see that no reasonable chance of contamination to the water exists after it has left the filters. This involves good work and careful supervision; and I shall not need in this company to labour the point that in such a matter they are a good investment.

"*On Dangerous Constituents of Colliery Air*," *by* Professor FRANK CLOWES, D.Sc., Lond., University College, Nottingham.

IN considering the conditions under which the atmosphere of the coal mine may become unfit for respiration, two main causes may be stated.

1. The reduction of the amount of oxygen in the air below the proportion which will support life, without the introduction of any gas which produces prejudicial effect when inhaled.
2. The introduction into the air of some gas or gases which will produce prejudicial effect when inhaled.

The simple dilution of the air with innocuous gas may occur from escapes of fire-damp or of nitrogen. The oxygen may be reduced in this way from about 21 per cent., which is the normal amount, to about 7 per cent., before danger is actually caused to those breathing the air. Even before this limit is reached, however, the breathing becomes laboured and rapid, these symptoms appearing when the reduction of the oxygen reduces its amount to 12 per cent. It must be remembered that nitrogen and methane (fire-damp) produce in themselves no poisonous effect; they simply act as diluents. Nitrogen, if introduced into air in quantity sufficient to extinguish a candle-flame, reduces the oxygen only to 16 per cent. and causes no danger.

The Introduction of certain other Gases, however, produces an effect additional to that caused by their diluent action. Amongst these are mainly to be considered carbonic acid (carbon dioxide) and carbonic oxide (carbon monoxide): the former gas in comparison with carbonic oxide is almost harmless.

The importance of the presence of much carbonic acid in the air depends upon the way in which it has been introduced. If it has been produced by combustion, it never reaches a dangerous proportion, even when it causes the extinction of flame. About 3 per cent. of this gas may be introduced into the air by combustion, and 10 per cent. is necessary to produce danger by respiration. Hence the extinction of a flame need not imply any danger in breathing air which has been charged with carbonic acid, only by combustion.

If, however, the carbonic acid gas has escaped ready formed into the air, the quantity sufficient to extinguish a flame is 14 per cent., and this is decidedly a dangerous amount, since it rapidly causes insensibility and therefore helplessness.

It is, therefore, evident that the extinction of flame—which is the rough test of respirability usually applied to colliery air—may lead to the condemnation of an atmosphere which is respirable with perfect safety, and this is true whether the air is rendered extinctive by nitrogen or by the carbonic acid produced by combustion. Although this fact should not lead to any relaxation of caution in entering air which is extinctive to flame, it should be borne in mind that rescue parties may frequently persist in their humane efforts even when ordinary lamp or candle-flames are extinguished.

Very different is the case when even small quantities of carbonic oxide are present in the air. This gas is produced in the air of the coal-mine by certain explosives used in blasting, but is usually only formed in dangerous amount by an extensive fire-damp explosion, and especially by an explosion in which coal-dust has played a part. An atmosphere containing seriously dangerous amounts of this gas, produces no visible effect upon an ordinary candle or lamp flame: hence this flame-test wholly fails to indicate the most serious danger in colliery air. Dr. Haldane finds that even 0·2 per cent. of carbonic oxide in air is dangerous, and suggests a very practical test of safety by means of a living mouse; he also gives details of methods for detecting and measuring the gas, which the writer has repeated with complete success. In his original papers, and in a report to the Home Secretary, Dr. Haldane sums up the important results of his researches on the effect of breathing carbonic oxide in air, and on the investigations referred to above. A summary of this important work done by Dr. Haldane, and of much work carried out by the writer in connection with the detection of dangerous gases which may be present in the air of the coal-mine, will be found in a book by the writer, which is published by Messrs. Crosby, Lockwood & Son, on "The Detection and Measurement of Inflammable Gas and Vapour in the Air."

"*Comments on the Interim Report of the Departmental Committee on certain Dangerous Trades, 1896,*" *by* JOHN T. ARLIDGE, M.D., A.B.Lond.

THE subject of occupation in relation to health has, after a long period of neglect and indifference, vindicated for itself a prominent place in sanitary science, and I rejoice to say in the proceedings of this Congress also.

For above thirty years I have been impressed with its importance, and have used what opportunities occurred to me to promote its study. Circumstances connected with my place of residence and with factory duties as a certifying surgeon directed my attention primarily to the manufacture of china and earthenware, and to a smaller degree to coal mining and the iron trade; shortly afterwards, the singular want of knowledge both within and without the medical profession concerning the conditions and circumstances of industrial labour and their consequences to the employed, prompted me to extend my observations to the principal occupations of this manufacturing kingdom, and in pursuance of this purpose to visit the great seats of trade. The result of my inquiries I subsequently embodied in my treatise on "The Diseases of Occupations," published in 1892.

Since its appearance much has been done in the same direction. Government Commissions and Committees have been instituted to examine the health conditions of numerous occupations, chiefly in regard to amendments and extensions of the Factory Laws demanded by popular opinion. But let it not be supposed I am unconscious of the splendid work done years ago by the medical officers of the Local Government Board, for the most part under the auspices of the then distinguished medical chief, Sir John Simon.

The latest contribution to the series of Parliamentary and Departmental inquiries is the recently published "Interim Report of the Committee upon certain miscellaneous Dangerous Trades." 'Of some of its inferences I must profess myself sceptical, and think it worth while to subject them to brief criticism, on this occasion in reference chiefly to the sections on the rubber manufacture.

As a preliminary general remark I would say that the composition of the Committee was deficient of the medical element. Of its few members only one belonged to the profession; one was a lady occupying the position of a factory inspector, another was a well-experienced male inspector, and the remaining one, the chairman, a member of Parliament.

To this heterogeneous body was committed the task to discover what diseases prevailed among the workpeople in the several trades examined, and what were the causes of those diseases. To any ordinary mind such an investigation would appear to be the special function of men instructed in medical knowledge, and experienced in the recognition of diseases and their causes, whether or not discoverable in the nature and conditions of the work pursued.

A primary point was to discriminate between disorders actually due or *incidental* to an occupation, and those casually or accidentally found with it. To my mind this differentiation of disease factors is not satisfactorily accomplished. This will not surprise medical men accustomed to making diagnoses, and to sifting statements made by uneducated people as to the causation of diseases which have no basis other than preconceived ideas, traditions and prejudices, the offspring of ignorance. None know better than medical men how constantly the beliefs and assertions of the lay mind concerning the nature and causes of a malady have to be ignored, even when the desire to get at the truth exists.

There appears to me to be a deficient recognition of this fact. Statements seem to have been received without reserve from the witnesses examined. Groups of symptoms have been assigned to particular callings without critical examination. Thus many are associated as *incidental* consequences of an occupation which are known to be more or less largely attributable also to sedentary labour generally, especially when pursued in factories where crowding, air vitiated by gas, numerous breaths, exhalations and odours, and prolonged hours of labour are present. Surely in these accidental particulars we may find adequate causes for deficient appetite, more or less anœmia, faintness, or lightness of head, nausea, and other minor derangements of health, the results of mal-nutrition and the want of fresh air and exercise. Moreover, all such insanitary conditions predispose to consumption, to lung and gastric disease. We are thereupon asked to accept this string of symptoms as the actual consequences due to naphtha inhalation and to the process of bronzing in lithographic and other works; whilst we get no enlightenment as to the definite effects of naphtha, or of the bronzing process.

The effects of naphtha are not differentiated from those of carbon bi-sulphide,—still used in some factories. The consequences of the latter substance are well known since Delpech investigated them. It is to the mixture of this substance in the air with the naphtha vapour that I would assign the occurrence of the graver evils enumerated. But I would further urge that better evidence is wanted to prove the actual dependence of certain disorders upon any one substance used in the manufacture, than a casual case, or accident; and particularly so where the employed consist mostly of females subjected to a host of unhealthy conditions of sedentary factory employment.

From my knowledge of rubber works the long catalogue of evils enumerated in connexion with the occupation is, to say the least, magnified. Thus, as to anœmia, this is by no means so frequent or so severe as in textile factories and in many trades, such as machine lace making, dressmaking, and in other forms of labour followed largely by women, where no naphtha occurs.

It is readily conceivable that the odour of naphtha may prove nauseating to some squeamish stomachs, especially when it is first encountered, and before food is taken; but the almost universal rule is that workpeople are soon habituated to it and unaffected by it. At the same time it must be admitted that certain sensitive individuals do not acquire indifference to it. Such persons should not persevere with the trade.

I can fully understand the belief of the workpeople in rubber factories that they can eat food that has been exposed to naphtha vapour with more relish in their workshops, where that vapour abounds, than in the purer air of a detached room, or in the outside air, for this reason: That the sense of taste whilst breathing the vitiated air remains dormant, so to speak, and is not affected by the impression of the same flavour present in the food; whereas, after contact with a purer atmosphere, its normal sensation is revived, and the disagreeable taste and odour of the offending substance taken is made very perceptible.

But though the notion of the workers admits this explanation, it by no means affords a reason for the continuation of the unclean custom of taking meals in shops fouled by the vapour, and the proposed rule that meals be not eaten in such places, and that a detached mess room be provided for the purpose, is fully justified.

There is no question that naphtha vapour permeates the air in rubber works, and that its odour is disagreeable to people generally, and noxious to some owing to constitutional peculiarities. Nor can anything but praise be given to every effort to lessen its diffusion and to mitigate its effects by dilution, as attainable by effective ventilation and suitable structural arrangements. Many storied buildings are ill-suited for the business, which calls for detached blocks and for ample space in the shops, and facilities for the rapid escape of the vapour.

This diffuses rapidly in all directions, not so exclusively upwards as the Report insinuates, for it is heavier than atmospheric air. In the case of the carbon sulphide again, its vapour is so dense that it sinks to the floor, and so marked is this circumstance that certain French doctors have recommended perforation of the shop floor to allow its exit downward.

A suggestion is to be found in the Report that consumption and chest diseases are sometimes direct consequences of naphtha inhalation. I do not see a tittle of evidence in its support. The few statistics printed are too few and valueless for the purpose, and *à priori* considerations tell against it, inasmuch as naphtha belongs to the same chemical series as turpentine, creosote, and other hydrocarbons which are believed to be of service in the treatment of phthisis and lung diseases. In fact among the many workers in naphtha vapour there is a remarkable absence of cough when at work, and if phthisis does occur, no proof is forthcoming that it does so in a relatively higher ratio than with other operatives.

In my opinion, too, we are still without adequate proof that naphtha, with ordinary care, perceptibly produces disease and shortens life. Still, like as in almost every occupation followed by human beings, that of the rubber manufacturer has some drawbacks to the full enjoyment of life and robustness of health. Those great ends are to be attained only at the sacrifice of almost all the conditions of so-called civilized life. What we are to aim at is to avoid such sacrifice and to secure healthy and happy lives by means of every sanitary expedient practicable.

"*A State Medical Service; what should it include?*" *by*
HERBERT MANLEY, M.B., D.P.H.
(FELLOW.)

ABSTRACT.

THE idea of a state medical service was mooted so long ago 1856 by Dr. Rumsey in his very interesting essays on St Medicine. It is proposed in this brief paper to bring this up date with the present service of Medical Officers of Health as basis.

The various districts assigned to Medical Officers of Health are then classified according to work done and emolument with a view to the abolition or material improvement of the less efficient and worst paid members of the sanitary service.

The writer then proceeded to enumerate in detail the appointments which may advantageously be combined with that of Medical Officer of Health, to provide a sufficient salary to avoid the necessity of private practice. These are as follows :—

1. Superintendent of infectious hospital.
2. Vaccination Superintendent.
3. Superintendent Registrar of Births and Deaths.
4. Coroner's Assessor or Medical Expert.
5. Medical Officer of Schools and School Boards.
6. Certifying Factory Surgeon.
7. Analyst?
8. Police Surgeon?

The future position of such an officer is then dealt with, having especial reference to the necessity for fixity of tenure and other conditions of State service.

"*Notes on Sanitation in Denmark,*" *by* J. CARLSEN, M.D., Medical Statistical Secretary of the Danish Royal Board of Health.

1. Death-rate per cent. for the whole country :—
1890, 18·9; 1891, 19·8; 1892, 19·3; 1893, 19·0; 1894, 17·6.
Death-rate per cent. for population in the towns :—
1890, 20·0; 1891, 21·0; 1892, 20·0; 1893, 19·4; 1894, 18·0.
Death-rate for per cent. Copenhagen (330,000 inhabitants):—
1890, 21·4; 1891, 21·7; 1892, 19·4; 1893, 20·3; 1894, 19·3.
Death-rate per cent. for Larhus (36,000 inhabitants) :—
1890, 21·0; 1891, 19·0; 1892, 17·0; 1893, 20·0; 1894, 17·0.

2. Death-rate for *100,000 living persons in towns*, 1890–93, from—*Small-pox*, 0·4; *Cholera*, 0·0; *Diphtheria*, 104; *Croup*, 41; *Erysipelas*, 9; *Scarlatina*, 19; *Typhus fever* (T. exanthematicus), 0·1; *Enteric fever* (Febris typhoidea), 15; *Relapsing fever*, 0·0; *Puerperal fever*, 8; *Diarrhœa* (Cholorine et Catarrh intest. acut.), 118; *Dysenteria*, 0·3; *Whooping cough*, 43; *Measles*, 27; *Influenza*, 69; *Febris rheumatica*, 5; *Tuberculosis*, 283.

For the country population no death-rate can be given, but as the city population (770,000 persons) for a great part is distributed over the whole kingdom in a great many small towns (the metropolis has 330,000 inhabitants; its suburb, Fredriksberg, 50,000; 400,000 are living in seventy-four towns, the most of a rural character), it may be supposed that the above given death-rates from infectious diseases in the town population do not differ to a great extent from the death-rates for the whole kingdom (2,200,000 inhabitants).

3. *Prevailing methods of excreta disposal.*

Metropolis. *Sewers* receiving both rain and waste water, but not sewage from water-closets. The sewage has its outlet in the harbour, frequently flowed through by a strong current. No water-closets, but an obligatory tub system; the contents deposited outside the town. The removal of refuse from houses and streets is carried out by public contract; the house refuse is collected in the yards in transportable reservoirs of galvanized iron with a cover. The refuse is removed to depôts in the environs of the city.

Provincial towns. Thirty-four towns have drainage in almost every street. The rest of the seventy-four towns have open gutters. A single town has water-closets; twenty towns have complete tub system; twenty have partly tubs, partly privy-pits; the remaining have privy-pits. Removal of house and street refuse and of night-soil is organized by the authorities only in twenty towns. In a single town the application of pulverised peat for all tubs is compulsory.

4. *Water supply.*

The metropolis has water-works—principally spring water—well filtered. Of seventy-four provincial towns thirty have water-works (the greatest part subterranean water or spring water, a few river water); the remaining forty-four towns have wells—as a rule every house has a well. Many wells have bad water. By the sanitary by-laws in most provincial towns the Board of Health is authorised to have the well water examined, to prohibit the use of the well, and in case of necessity to have it filled up.

Some villages have central water supply from springs, the most are using well water.

5. *Measures adopted for ascertaining the prevalence of infectious diseases.*

For cases of *Asiatic cholera*, *yellow fever*, *dysentery*, *exanthematous typhus*, *small-pox* and *pest*, immediate notification is compulsory upon every medical man, and upon everybody who knows or suspects that a case of sickness, occurring in his household, may belong to this class of diseases.

When diphtheria, scarlet fever, measles, typhoid (enteric) fever, or other diseases are under so-called *public management*[*] the same compulsory immediate notification is required.

It is the duty of every practising medical man to give to the Medical Officers *weekly returns*, comprising the observed cases of the above named diseases, besides other diseases, as meningitis, cerebro spin. ep., croup, tussis convulsiva, angina parotidea, febr. intermittens, febris puerperalis, erysipelas. febr. rheumatica, pneumonia crouposa, tracheo-bronchitis, broncho-pneumonia and bronchit. capillaris, angina tonsillaris, cholerine and catarrh, intest. acut., venereal diseases, scabies, and delirium tremens. The monthly figures from these returns are published every month by the Royal Board of Health in a medical paper. The Medical Officer of the Metropolis gives a weekly survey.

6. *Measures adopted for isolation of infectious diseases.*

7. *Hospital accommodation for infectious diseases, whether provided, and if so, whether by the State or by private subscription.*

When a disease is under public management (the above named serious diseases, Asiatic cholera, etc., are *always* under "public management"; the other infectious diseases when appearing in a malignant form may be subject to "public management" by a decree from the Minister of Justice) the Board of Health has to provide *isolated localities* (public buildings, tents, huts or the like), and in case of urgency may take over private property for the purpose. The Board of Health has power to demand that a person attacked, or suspected to be attacked, be removed to those localities, when he cannot be sufficiently isolated in his home.

In almost every town, and in the greatest part of the country districts, every person afflicted with diphtheria, scarlet fever, typhus (enteric) fever, and meningitis cerebro-spina epid., has a *right to claim free admittance* to the hospital for infectious diseases, provided the claim is raised immediately on the outbreak of the disease, or when the nature of the disease is recognised. Persons afflicted with venereal diseases can everywhere require free admittance to a public hospital. The kingdom has many hospitals for infectious diseases: in the metropolis two (c. 500 beds), in the provinces thirty (c. 600 beds); moreover, special departments for infectious diseases are attached to many provincial hospitals. The total number of beds, intended for patients with these diseases, in the whole kingdom may be estimated at 1,500. The voluntary use of these beds on the part of the population is considerable and increasing. In the year 1894 11—12,000 *cases of diphtheria* (including croup), *i.e.*, 60 per cent. of all cases treated by the medical men in the kingdom; and 1,700 *cases of enteric fever*, *i.e.*, 60 per cent. of all cases treated by the medical men in the kingdom, were isolated in the hospitals, or hospital departments for infectious diseases. All these hospitals are built *at the public expense* (from the Treasuries of the Communes); the annual expenses are defrayed partly from the Treasury of the State, partly from the Treasury of the Communes.

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[*] Vide "Denmark: Its Medical Organization, Hygiene, and Demography." Presented to the 7th Internat. Congr. of Hyg., London, 1891, Copenhagen. 1891, p. 326.

8. *Methods of disinfection.*

Disinfecting apparatus is attached to all hospitals for infectious diseases, and several other hospitals (some have stoves for dry heat, the most have stoves for steam) as a rule standing at the service of the general public. When diseases are under "public management" disinfection of the infected localities is compulsory. Without "public management" the medical men have a right to claim disinfection at *the public expense* for cases of diphtheria, scarlet fever, enteric fever, and meningitis cerebro spinalis epid. In many Communes some persons are permanently appointed as "disinfecteurs."

"*Argentine Republic and its capital, Buenos Aires*," *by* Manuel J. Pelegrin, Consul for the Argentine Republic for Newcastle-upon-Tyne and District.

Area of the Republic, its Climate, Immigration, Diseases, Hospitals, &c.

The Argentine Republic has an area of about 1,212,000 square miles (ten times the size of Great Britain and Ireland) on the eastern side of South America, with a very extensive seaboard on the Atlantic. Speaking generally, the climate is temperate and healthy.

The number of immigrants who landed in the Republic in

1895 was 61,226 (which includes 8,912 families), being an increase of 6,506 as compared with 1894. The first quarter of 1896 shows a considerable increase compared with the same period of 1895. The arrivals, which exclusively consisted of European immigrants have numbered for the quarter 17,949, against 10,337 in 1894, being an increase of 7,612, or 74 per cent. The influx of passengers and foreign immigrants has also been in excess of that of last year, as during the first quarter 34,150 were landed as against 13,341 at the same period of last year, showing an increase of 156 per cent. The great proportion of the immigrants are Italians and Spaniards.

The Argentine sanitary laws and regulations are put in force by both the Government and Municipal Authorities for the preservation of the health of the people; and these measures together with the fine climate and abundant space for all comers, keeps the Republic fairly free from pestilential or epidemic diseases. There have of course, been epidemics of yellow-fever and cholera, resulting in a great number of deaths, but they were the result of importations into the country, and led to the Government establishing stringent quarantine regulations as stated in a paper submitted to the Congress at Liverpool in 1894 by Mr. Hansen, Consul for Argentina. Under Government and municipal auspices there have been established hospitals of all kinds in Buenos Aires—hospitals for women, clinical hospitals, hospitals for women and children, maternity hospitals, hospitals for chronic diseases, isolation houses, hospitals for invalids, &c., and there are also French, German, Italian, Spanish, and English Hospitals. There are training institutions for nurses and health officials, conducted under the public authorities.

The Capital. Numbers of Deaths Yearly.

Situate upon the River La Plata, one of the finest rivers in America, Buenos Aires holds commanding position for commercial purposes. At the beginning of the century it had a population of about 30,000, and it had increased to between 80,000 and 100,000 about twenty years ago; whilst now, owing to the enormous influx of people from all parts of the world, the population of the city and its suburbs is about 700,000, with the prospect of a still more rapid increase in the future.

The number of deaths in the past eight years has been as follows: 12,367 in 1888; 14,736 in 1889; 16,417 in 1890; 13,014 in 1891; 13,014 in 1892; 13,000 in 1893; 13,402 in 1894; and 14,947 in 1895. It will be observed that though the population has been rapidly increasing in the last seven or eight years, the deaths have not increased in equal ratio.

The return of deaths from endemic diseases during 1895 is as follows:

	No. of Cases.	Per 1,000 Deaths.
Yellow fever	1	0·07
Typhoid fever	208	13·89
Small-pox	277	18·49
Measles	205	13·67
Scarlatina...	598	39·95
Whooping cough...	44	2·78
Diphtheria, croup, and sore throat	381	25·63
Influenza	23	1·52
Scurvy	4	0·27
Asiatic cholera	175	11·71
Cholera Nostras	6	0·40

A comparison of the above return with those of the previous seven years shows that the deaths from fevers, diphtheria, and small-pox, have steadily decreased, and that "influenza" did not make its appearance until 1892—at least no cases are recorded under this head before that year.

The statistics of infantile mortality (under 2 years of age) are startling, as the following return for 1895 will show: Atresia, 442 deaths; bronchitis, 332; bronchial pneumonia, 603; croup and diphtheria, 100; and general debility, 321; gastro-enteritis, 670; meningitis, 692; pneumonia, 366; infantile tetanus, 228; small-pox, 76; and other diseases make up a total of 5418 deaths of children under 2 years in 1895.

Deducting the 5,418 children under 2 years of age from the death returns leaves 9,529 as the total deaths above that age last year in a population of nearly 700,000.

The National Board of Health. Its Regulations.

As already stated, there is a National Board of Health for the regulation of all matters connected with health and sanitation, under whose direction the municipal authorities put in force the law. The Board of Health is divided into two departments—one the administrative and the other the scientific. There is a central school for the training of male and female nurses, and hospitals are provided for infectious diseases, and are maintained chiefly out of public funds. All cases of infectious diseases must be notified to the public officials, and, whenever possible, the patients are removed to hospitals by a trained staff of officials. In cases where removal to a hospital is not possible, the doctor is authorised to order the isolation of the house in which the disease occurs, and the sending away of all persons whose attendance is not absolutely necessary for the patient. Printed directions are issued for disinfecting the house and its contents. No clothing of any description is allowed to be removed before being washed in a strong disinfecting fluid, and then must be taken and put into the disinfecting apparatus provided by the authorities. All officials when employed on disinfecting work must wear special clothes, which are carried in a bag to the house and there put on, and when the work is completed, the hands and other parts of the body not protected by the special clothing must be thoroughly washed first with soap and water, and then in an alcoholic preparation mixed with bichloride of mercury diluted to a proper strength. Articles in the house must be washed and then taken to the fumigating apparatus at the hospital. The floors, walls, ceilings, have to be carefully swept and washed, and the entire house fumigated, and twenty-four hours afterwards it is reopened and free ventilation allowed for eight days, after which it may be re-occupied. The regulations are stringent, and, if thoroughly carried out, ought to ensure the country against the spread of infectious diseases.

Sources of Water Supply.

Argentina is well watered by its great rivers, the Uruguay, Paraguay, Parana, Rio Negro, Plato, Colorado, Chubut, &c., with their many affluents, all flowing from the high mountains on the western boundary of the country into the Atlantic, and from these rivers is chiefly drawn the water supply of the country, apart from the rain water.

Sir **Charles Cameron** (Dublin) said that they could not separate that day without passing a vote of thanks to Professor Corfield for the manner in which he had presided over this Section of the Institute, and he rose to discharge that duty in no perfunctory manner. From his long friendship with the President, and from an intimate knowledge of the valuable contributions which he had made to sanitary science, and the great interest he had taken in promoting sanitation, he had the greatest pleasure in moving that the warmest thanks be given to the President for the admirable way in which he had presided over their deliberations.

Dr. **Alfred Hill** (Birmingham) very heartily endorsed the commendatory remarks of Sir Charles Cameron in proposing that resolution. Dr. Corfield was a distinguished worker in the domain of sanitary science, and he was glad to have seen him in the position he had taken at this meeting of the Institute, and he had great pleasure in seconding Sir Charles Cameron's resolution.

The resolution was carried with hearty applause.

THE PRESIDENT OF THE SECTION (Professor Corfield) said he was exceedingly obliged to his old friends Sir Charles Cameron and Dr. Hill for the very kind way in which they had proposed and seconded the resolution. He could only say that he had tried to do his duty, and if they thought he had done it, that was sufficient satisfaction to him. However they must not part without according a vote of thanks to the Secretaries, for to the Secretaries was due a great deal indeed of the successful carrying out of the business of the Section. Secretaries he thought had more to do with the success of the Sections than any one else. Dr. Sykes, Dr. Scurfield, and Dr. Beatley had been no exception to the rule, and he proposed that a hearty vote of thanks be accorded to these gentlemen.

The resolution was cordially agreed to.

SECTION II.

ENGINEERING AND ARCHITECTURE.

PAPERS AND DISCUSSIONS.

"*The Treatment of Sewage by Chemicals in Perfect Solution,*" *by* HERBERT HENRY LAW, Assoc.M.Inst.C.E., F.R.Met.Soc.

(MEMBER.)

IT has been long known to chemists that to ensure the most rapid and complete chemical reaction substances should be presented to each other in a perfect state of solution.

In the case, however, of the treatment of sewage by means of chemical reagents it is only recently that an endeavour has been made to carry out this principle in practice.

Lime is one of the substances most generally used for the treatment of sewage, and owing probably to its requiring seven hundred times its weight of water to perfectly dissolve it, it has been customary to add to the lime only sufficient water to form a thin paste, known as "cream of lime."

The disadvantages attending this mode of dealing with the lime, however, are manifold, namely:—

First. The lime, after being burnt, always contains foreign substances and portions imperfectly burnt, which are perfectly inert as far as chemical action on the sewage is concerned, and which are simply deposited with the sludge and add to its bulk.

Secondly. The consistency of the "cream of lime" is constantly varying, so that it requires the continuous attention of an attendant to endeavour as far as possible to regulate the quantity added to the sewage from time to time, but even with the best attention it is quite impossible to determine the actual quantity of lime being added at any given moment; sometimes it will be in excess of that required and sometimes the quantity added will be insufficient.

Thirdly. Owing to both the sewage and the cream of lime being more or less viscid the mixture between them is very imperfect, and it is certain that after even considerable trouble has been taken by agitation to promote a thorough admixture, much of the sewage will escape without having been brought into sufficiently intimate contact with the lime to produce any chemical reaction upon it.

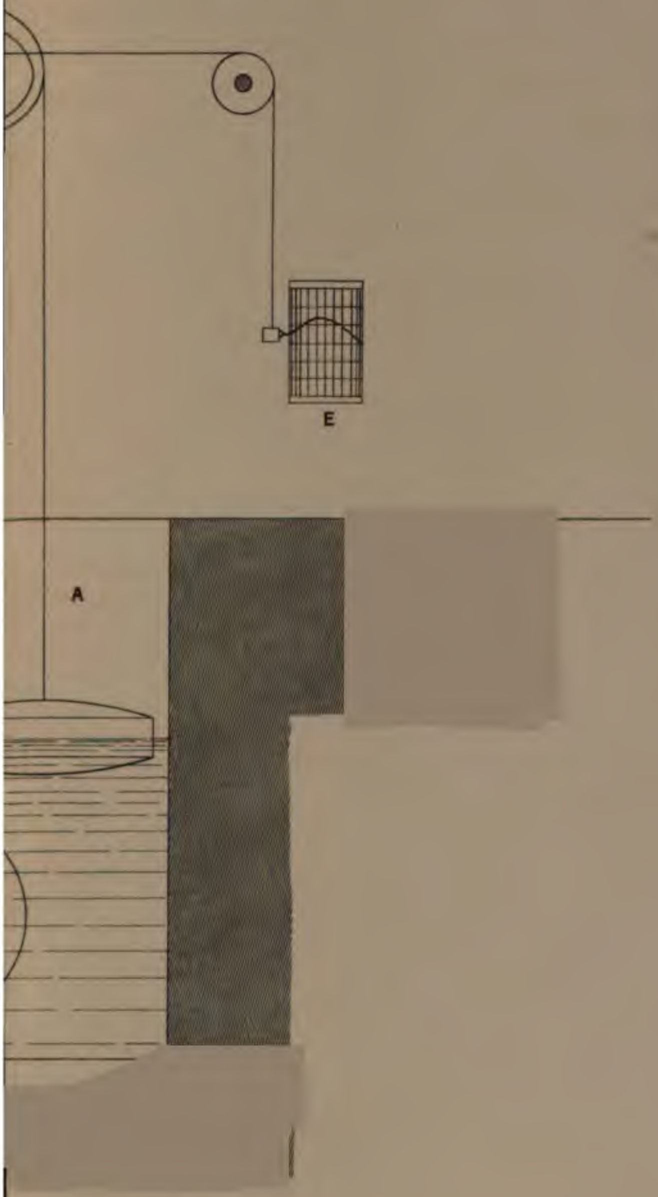
There are two circumstances which make it very difficult if not impossible to insure the quantity of the chemicals bearing always the due proportion required to produce the same amount of purification in the sewage, namely, in the first place the difficulty of measuring the quantity of chemicals added: and in the second place the varying quantity and quality of the sewage.

The first of these difficulties is at once removed by adding the chemicals to the sewage in a state of perfect solution.

As regards the second difficulty so far as relates to the variation in the *quantity* of the sewage, this may be removed by the adoption of automatic means of so regulating the quantity of the chemicals added that they should always bear the same proportion to the quantity of sewage flowing. The variation in the *quality* of the sewage will depend upon several circumstances, some more or less regular in their incidence, and some entirely fortuitous. It is quite possible as regards the first of these to devise mechanical means for so automatically regulating the supply of the chemicals as to preserve a more or less constant proportion between them and the polluting matter in the sewage. But it is obviously impossible by self-acting means to provide for these fortuitous circumstances, such as sudden discharges of manufacturing refuse or heavy falls of rain which may occur at any moment unexpectedly.

At Oldham it has been determined to treat the sewage by chemicals in the state of saturated solutions, and an apparatus has been designed which will so regulate the quantity of the chemicals added to the sewage that under normal conditions it shall at all times bear the same proportion to the volume of the sewage arriving at the outfall works. And the means are also provided of altering this proportion at different times of the day and night should the difference in the composition of the sewage render it expedient to do so.

It is proposed to treat the sewage by the addition of lime and alumino-ferric. After the sewage has passed through a screening chamber a portion of it is lifted by a centrifugal pump into one of two tanks, each capable of holding 300,000 gallons. The lime is first mixed with water in one of Michele's lime mixing machines, in which the insoluble matter which the rough lime may contain is separated and falls to the bottom while the lime passes out between two rubbing surfaces, which reduce it to the state of smooth cream. This cream of lime is injected into the suction-pipe of the pump in a proportion slightly in excess of that required to form a saturated solution. In its passage through the centrifugal pump the lime becom thoroughly mixed with the water. The tanks being in duplicat als applied to Sewage.



while one is being filled, the other, in which the excess of lime has fallen to the bottom of the tank leaving a clear saturated solution of lime water, is supplying the same by gravity to the sewage as it arrives at the outfall works.

The alumino-ferric is used in the form of slabs or cakes, 21 inches by 10 inches by 4 inches, each weighing 56 lbs. A tank is provided sufficiently large to contain two balanced cages, each capable of holding 12 cakes, and so arranged that while one cage is immersed in the tank the cakes which it contains being in process of being dissolved, while the other cage is above the tank so as to be refilled with fresh cakes.

The alumino-ferric being very soluble, the solution in the tank is always maintained as a *saturated* solution.

The apparatus for automatically regulating the respective quantities of the solutions of lime and alumino-ferric is as follows:—

A well on the side of the main outfall sewer is connected with it in such a manner, that the water rises and falls in the well according to the varying depth flowing in the sewer, carrying with it a copper float three feet in diameter, to which is attached a copper band, the other end of which is wound round a drum, which consequently revolves in either direction as the sewage rises and falls in the main sewer, and the position of which at any moment depends upon the quantity then flowing.

The lime solution is conveyed by gravity to a tank on the side of the main outfall sewer, its flow being regulated by a floating valve. A vertical cylinder, eighteen inches in diameter, is connected with the tank, and within this cylinder a second cylinder fifteen inches in diameter is introduced, the space between the two cylinders being occupied by an india rubber ring, which permits the inner cylinder to rise and fall within the fixed cylinder, while it prevents the escape of the lime water. The upper part of the inner cylinder on the side next the sewer is formed as a weir, twelve inches in width. The inner cylinder is attached to a pulley, which is supported by a copper band which passes over a fixed pulley, and is then wound round a helical drum, fixed on to the same shaft as the drum which revolves with the rise and fall of the sewage in the outfall sewer.

The radius of the helical drum at any given point is so adjusted, that the quantity of lime water flowing over the weir at all times bears the same proportion to the quantity of sewage flowing at such times through the outfall sewer. To ensure this adjustment it is necessary that the relative positions of the level of the water in the tank, and the level of the lip of the weir should not be affected by any variation in the former, which obviously must vary in accordance with the quantity of lime water passing through it at any given moment.

This object is effected by connecting the shorter arm of a lever with the float of the valve which regulates the admission of lime water to the tank, and by the connection of the other end of the copper band which passes under the pulley attached to the top of the weir cylinder with the longer arm of the lever. The respective lengths of the arms of the lever being in the ratio of one to two it will be seen that the rise or fall in the level of the water in the tank will cause an equal rise or fall in the level of the weir, and will not therefore affect the quantity of lime water flowing over the same.

The aluminino-ferric being very soluble, requiring less than twice its weight of water to form a saturated solution, the regulation of its flow is managed as follows. A copper band is wound round a small drum upon the same shaft as the helical drum, the other end of the band being attached to a conical spindle which passes through a circular hole in a thin plate in the bottom of a small tank which is fed from the larger tank containing the saturated solution of the alumino-ferric, and which is always maintained at the same level in the smaller tank by a ball valve. The quantity of the alumino-ferric discharged with any given position of the spindle is regulated by the diameter of the spindle at the point which is then level with the thin plate and so reducing or enlarging the area of the hole through which the solution is discharged.

The apparatus is also made to record continuously upon a paper diagram the height of the sewage flowing at any given moment through the outfall sewer. A band wound round a small drum on the same shaft as the drum, actuated by the float in the sewage well, is attached to a recording apparatus similar to an ordinary self-recording tide gauge.

The ends of the copper bands are so attached to the floats and levers as to afford the means of perfect adjustment.

The excess of lime which is deposited in the lime water tanks is run off into the chamber which receives the sludge from the precipitation tanks, and being mixed with the same, facilitates the process of pressing it.

In times of heavy rain, when the amount of rain water exceeds a certain limit, an adjustable stop prevents the further rise of the regulating float in the sewage well, and so limits the supply of the chemical solutions.

The variations in the quality of the sewage under normal conditions at different hours of the day depend upon the habits of the population, the extent to which manufacturing industries influence the sewage, and the leakage into the sewers. And when these have been ascertained by careful observation it will be quite possible to arrange an automatic adjustment regulated by clock-work which shall approximately insure that the quantity of chemicals added shall be proportional to the quality as well as to the quantity of the sewage.

All that would be required would be that the intermediate pulley between the lever and the weir should be raised or lowered by a properly shaped cam revolving once in every twenty-four hours.

[*For discussion on this paper see page* 495.]

On "The Purification of Sewage by Filtration," by HENRY LAW, M.Inst.C.E., F.R.Met.Soc.

(FELLOW.)

THE object of the present paper is rather to elicit than to impart information as to the conditions most favourable to the successful purification of sewage by filtration; and as to the means by which those conditions can be most perfectly fulfilled in practice.

The desiderata are—the permanence of the filter—the greatest possible removal of polluting matter—and effecting this removal in the least possible time.

Formerly it was supposed that filters acted simply *mechanically*, by only straining out of the water those foreign substances which were contained in it in a state of *suspension.*

It is, however, now fully established that the process of *filtration*, or the passing of impure water through a porous bed, not only arrests those foreign substances which are held by it in *suspension;* but that in those cases in which the polluting organic substances in *solution* have an affinity for oxygen, they are acted upon by chemical decomposition, and new products formed of an innocuous character.

And, yet more recently, it has become known that the agents through which this chemical decomposition and oxidation is effected are minute living organisms to which the name of *nitrifying organisms* has been applied while the process itself is termed *nitrification.*

The impurities contained in sewage always consist of matter both in a state of suspension and in solution.

So far as the substances held in suspension are insoluble the process of filtration will be purely *mechanical*, and will consist in the detention within the pores of the filtering medium of the solid particles removed from the liquid which has passed through the filter. As this process is continued the pores must gradually become filled or choked up, and as this takes place the power of the filter to allow the passage of the liquid through it will gradually decrease until the time will arrive when it will cease altogether.

It is therefore evident that for a filter to possess *permanently* the power to purify sewage, it is necessary that the insoluble matters in suspension shall have been removed previous to its being passed through the filters.

This leads to the conclusion that liquid sewage should be deprived by precipitation of the insoluble matters held in suspension previous to its being passed through a filter.

If by previous precipitation the insoluble solid matters have been removed from the sewage, its subsequent purification by filtration will be effected by *oxidation* promoted by the *nitrifying organisms* existent in the filter, and it is the filtration of sewage under these conditions that it is proposed in this paper to consider.

Now the natural forces which are brought into action in the process of chemical filtration are in some respects antagonistic to each other.

In the first place we have the *attractive* forces, which may be divided into the *homogeneous* and the *heterogeneous* attractive forces.

The *homogeneous* attractive forces are those which exist between the particles of the same matter, and consist of the attraction of *gravitation*, and the attraction of *cohesion*. The attraction of *gravitation* being the force by which the particles of bodies not in contact tend to approach or gravitate towards each other; and the attraction of *cohesion* that by which particles in contact resist the effort to separate them.

The *heterogeneous* attractive forces are those which exist between the particles of dissimilar substances, and consist of the attraction of *gravitation*, the attraction of *adhesion*, *capillary* attraction, and *elective chemical* attraction or *elective affinity*. The attraction of *gravitation* is universal and exists equally between particles of dissimilar matter as between particles of similar matter. The attraction of *adhesion* is the force which resists the separation of two dissimilar substances which are in close contact, and can subsist between two solid substances, or between a solid and either a liquid or gas. *Capillary* attraction subsists between a solid and a liquid or gaseous substance. And *elective chemical* attraction or *elective affinity* is a force existing between the ultimate atoms of dissimilar substances which causes them to intermix and results in a compound substance usually possessing properties entirely dissimilar from those of the substances from the union of which it has resulted.

In the second place we have the *expansive* force of the atmospheric air, which increases or lessens its bulk or density according to the pressure to which it is exposed.

When a liquid is subjected to the process of filtration these several forces are brought into action in the following manner.

The filter consists of a bed of greater or less thickness, more or less porous, and more or less pervious to the liquid to be filtered.

Owing to the force of *heterogeneous adhesion* each of the minute particles of which the filtering medium is composed has become *enfilmed* or surrounded by a film of atmospheric air, and by *capillary* attraction the small vacuities or pores existing between the several particles absorb and condense the atmospheric air in quantities dependent upon the amount of porosity and the nature of the substance of which the filter is composed. In the case of newly burnt animal charcoal the volume of air thus absorbed and condensed is equal to eight times the bulk of the charcoal.

The liquid to be filtered being passed on to the filter is caused, by the *attraction of gravitation*, or, in other words, by its *weight*, to pass through the filter; if *downwards*, the rapidity of flow will be proportional to the square root of the height of the column of the liquid, and if *upwards*, it will be proportional to the square root of the difference in the heights of the two columns; and consequently by varying the height of this column, or the difference between the two columns, the time occupied by the liquid in passing through the filter can be regulated.

As the liquid permeates the filter it is brought into close contact with the air which had been absorbed in the pores of the filtering medium, and through the intervention of the *nitrifying organisms* the organic matter is decomposed, and by *elective chemical attraction* is converted into new compound products which are innocuous, and being soluble are carried out of the filter in solution in the filtrate.

This process is continued until the air imprisoned in the pores of the filter is exhausted, when the further flow of liquid on to the filter is stopped, and that contained in the filter is suffered to drain away, making room for the absorption of fresh air. It is here that the *capillary* attraction comes into action as an antagonistic force, tending to retain the liquid in the minute pores of the filter.

The process of filtration is then suspended for a sufficient length of time to enable fresh air to be absorbed into the filter, and when this has been effected the operation is repeated.

The above is the method of filtration usually adopted, but Mr. Dibdin, the chemist to the London County Council, gives preference to a different mode of procedure. He considers that when the liquid is passed continuously through the filter sufficient time is not afforded for the *nitrifying organisms* to do their work, and he prefers to fill the filter with the liquid to be filtered until it just appears upon the surface of the filter, the channels for the escape of the filtrate having been closed. He allows the filter to remain in this state for an hour, and then runs off the filtrate, leaving the filter empty for about another hour.

The conditions which he lays down as those essential for the successful filtration of sewage or other foul liquid containing in solution but little free oxygen, and a large quantity of oxidisable organic matter are as follows, namely :—

"1. That the filter by cautious increments in the quantity of effluent, which in itself contains the necessary organisms, must be gradually brought to a state of high efficiency. This condition will be shown by the existence in the filtrate of a constantly increasing proportion of nitric acid.

"2. That the contact of the micro-organisms with the effluent to be purified must be effected by leaving such effluent at rest in the filter for a greater or less time according to the degree of purification required, the process being analogous to that of fermentation. The system employed in many places is to run the water straight through the filter and thus allow insufficient time for the work, with the result that the filtrate is soon in an unsatisfactory condition.

"3. That after each quantity of effluent has been dealt with the micro-organisms must be supplied with air, which is readily effected by emptying the filter from below, whereby air is drawn into the interstices. The filter must stand empty for an hour or more previous to another filling and a longer period of aëration, say twenty-four hours, must be allowed every seven or eight days.

"The life of a coke breeze filter worked in this manner is practically without a limit."

One inconvenience attending the use of either of these systems of filtration is the length of time occupied in the draining off of the filtrate, and in the aëration of the filter. In practice it may be considered that the filter is only actually at work for something like six hours out of the twenty-four; and consequently that the area of filter beds which has to be provided is four times that which would suffice if the process could be carried on continuously.

A method has been suggested by Mr. Lowcock of continuously supplying the filter bed with air under pressure, and this system has been tried in America by Col. Waring, who has communicated the results of his experiments in a paper which has been published in the Journal of the Sanitary Institute.

If this system is successful and the time occupied by the liquid in passing through the filter is sufficient to allow of the perfect nitrification of the organic matter contained in the same, the process of filtration might be carried on continuously.

But there are many points upon which further information is required, amongst which the following may be enumerated:—

The best material for the filtering medium.

The size to which this material should be reduced.

Whether the filtering medium should be the same material, and of uniform size throughout its entire depth.

The thickness of filtering material which gives the best results.

The best method of distributing the liquid to be filtered, and of collecting the filtrate.

The best rate for passing the liquid through the filter.

The chemical treatment which would produce the best effluent for subsequent nitrification.

The best methods to be pursued for the cultivation of the nitrifying organisms.

The best method of precipitation for freeing the effluent from matter in suspension.

The best way of supplying air to the filter on Mr. Lowcock's system.

How far the variation of temperature affects the efficiency of the filtering process.

[*For discussion on this paper see page* 495.]

' *The present status of Sewage Irrigation in Europe and America,*"
by H. ALFRED ROECHLING.
(MEMBER.)

ALTHOUGH the question of sewage irrigation has been again and again before the scientific public and especially the members of the Sanitary Institute, yet the author ventures to think that that aspect of it with which he intends to deal may be new to some of his hearers. But apart from this the subject is of such importance that it needs hardly an apology for introducing it again to-day.

What has perhaps more than anything else influenced the author in this decision is the attack that is more or less continuously carried on by all sorts of people against the application of sewage to land and which has recently been somewhat revived by the plea that sewage farms were capable of propagating infectious diseases.

The author, therefore, considers it might not be out of place to put on record the present status of sewage irrigation and the opinion held concerning it by those capable of forming independent and reliable opinions.

If such a review were, however, limited to this country only a restriction would be placed upon the subject, which appears quite unjustifiable, as this question is one of international importance. Every community, no matter in what state it may be, is confronted with practically the same difficulties, and it is, therefore, absolutely necessary, with a view to forming a correct opinion, to extend the range of observation as much as ever possible beyond this country. This the author purposes to do and he has endeavoured to obtain reliable information concerning other countries.

So far as this paper is concerned the term "sewage irrigation" includes all forms of applying sewage to land, as although the modes of application may differ the laws by which the purification in the pores of the soil proceeds are the same.

In passing it might be remarked, that sewage irrigation has been employed since the middle of last century. No doubt, originally an imitation of water irrigation—a method employed since very early times in countries like Egypt—sewage has been applied to land in Edinburgh, on the Craigentinny meadows, since 1760, and in Bunzlau, in Prussian Silesia, since 1740. Being, therefore, of such ancient date it is clear that this subject cannot afford a happy hunting ground for the ever active brain of patentees, and it has been suggested that perhaps the absence of strong capitalistic support has allowed the opposition voices to become stronger and louder in the same proportion as this treatment curtailed the usefulness of other patented methods probably thus proving the truth of the saying:—

> "Early to bed and early to rise
> Is of no earthly use, if you don't advertise."

These attacks have been carried out with such bitterness that people who had no means of critically examining the remarks of condemnation have been almost obliged to look upon the application of sewage to land as a thing to be avoided at any cost. To throw some light into this conflicting mass of statements and to put some well established facts before his hearers and the public generally will be the author's endeavour, so that those who are called upon to study this question may have no difficulty of finding out for themselves the true state of the case.

General Considerations.

Broadly speaking the constituents of sewage were formerly divided into two main classes, viz.:—the organic and the inorganic matters, which were said either to be dissolved or suspended according to the state in which they were held in the liquid. Since the ever memorable researches of Pasteur and Koch, however, which have been continued and further extended by a host of other scientific observers, it has been established that sewage contains another constituent which is, perhaps, the most important one, viz., the germs, which are the lowest form of living matter.

We must, therefore, now adopt the following division of the constituents of sewage, viz. :—

1. The organized matter or germs.—Pathogenic and non-pathogenic germs, germs of putrefaction, &c.
2. The inorganised matter.
   (*a*) The organic matter in suspension or solution.
   (*b*) The inorganic matter in suspension or solution.

The germs, micro-organisms, microbes, bacteria, or whatever other name we may give to them, are suspended in sewage and their number generally reaches into so many millions in one cubic centimetre (c.cm). They are not all of one and the same species; on the contrary, the number of species represented is often as bewildering as the number of germs themselves, and up to the present time we have only been able to examine a very few of them, the life history of which we are endeavouring to trace. Very much more remains to be done in this respect, indeed we cannot even yet be said to have established a proper system of identification or classification of microbes. Be that, however, as it may, we know now for certain that the germs of such infectious diseases as typhoid fever and cholera may be found in sewage, and this is sufficient to make the proper treatment of sewage a subject of the greatest importance.

As to cholera, fortunately we may dismiss it from our considerations, as the germ of Asiatic cholera will be but a very rare inhabitant of sewage owing to the absence of this disease from our shores, but with the bacillus typhosus the case stands somewhat differently, as practically speaking isolated cases of this disease occur in every large town throughout the year. The question, therefore, may well be asked, what becomes of the typhoid germ on sewage farms, has it been known to exert a baneful influence upon the health of those working and living on them?

It is, perhaps, well known that the late M. Pasteur up to about the year 1889 held opinions unfavourable to sewage farms as he was afraid they might act as propagators of the germs of infectious diseases.

The germs of typhoid fever, for instance, being as it were sown broadcast year after year over the land, the sewaged fields might act as breeding places for them whence passing into the air they could be carried away by the currents to any distance.

Fortunately, these fears of Pasteur, based as they were on scientific observation, have never proved true in actual experience, and it is generally believed that towards the end of his life this great observer somewhat modified his views on the subject of sewage farms.

The author knows of no recorded case in which it has been proved in an unmistakeable manner, that a well managed sewage farm has acted as the focus of a typhoid fever epidemic.

Let us take the case of the Berlin Sewage Farms, which are the largest in the world, having now an area of 22,881 acres (31st March, 1895), and where one might fairly expect any evil results would show themselves in a more marked degree than elsewhere. Nearly every yearly report mentions that it has not been possible to establish a connection between a recorded case of death and the application of sewage to land, and the report for 1888-89 contains this remarkable passage:—"Especial stress must be laid upon the fact, that not one case of typhoid fever (typhus abdominalis), has been recorded during the year upon any of the farms, though the eastern and northern portions of the city were visited at the commencement of the year with a severe attack of this fever, this being the first epidemic of any extent since the establishment of the farms."

In the year 1891, some severe cases of typhoid fever in the neighbourhood of one of the northern sewage farms were said by a medical practitioner to have been contracted on the irrigated fields, and as this report caused some stir, the City authorities, under the guidance of Professor Virchow carefully investigated the complaints, with this result, that it was not possible to produce conclusive evidence in their favour.

Again, it was asserted that the typhoid germ had been washed off the land and conveyed through the effluent streams into the water supplied to the City of Berlin, there causing an outbreak of typhoid fever. It is needless to say it was not attempted to support this theory by proof, as no trace of this germ was found in the water.

Further, a fear was expressed that typhoid germs might pass in a healthy condition out of the subsoil into the subsoil water, and then pollute the wells in the neighbourhood of the farms. With a view to ascertain the correctness of this surmise, the City authorities, and partly also the German Imperial Board of Health, investigated every suspicious case of disease most carefully, but were not able to identify the bacillus typhosus in any of the examined well waters.

Bearing all this in mind, one is forced to the conclusion, that the possibility of pathogenic germs doing further harm after systematic treatment on land is an exceedingly remote one, and probably some of the following causes are at work to bring about this fortunate state of things. Pathogenic germs appear to be more delicate than other germs, and probably perish very quickly in the struggle for existence with the countless host of other sewage germs; it is further stated that sewage is no favourable medium for this kind of micro-organism, so that it is not improbable that before their arrival on the farm, pathogenic germs are in a dying condition. On the surface of the land they are exposed to the decidedly injurious influences of the inclemency of the weather, and the bactericidal action of sunlight. On the whole, therefore, the chances of pathogenic microbes doing further mischief appear very small.

The foregoing remarks must be taken to refer to well-managed sewage farms, as the author is quite aware, there are a few sewage farms in existence on which the sewage is not purified. To single out, however, these farms and condemn in consequence the system itself appears on the face of it very absurd and very much after the fashion of the bad workman who complains of his tools. A good workman can do fair work even with indifferent tools, but when the workman is bad he will not be able to produce good work even with the best of tools. The author has seen sewage farms, where an intelligent management was capable of producing a fair effluent even under very unfavourable conditions, he has also seen farms where a good effluent might easily have been obtained, but where under a management deserving the name of gross mismanagement—everything being in a most neglected condition—the sewage ran off the land in almost a worse state than it went on and the pollution of the stream that took the effluent was the only possible consequence.

The first condition for a successful sewage farm is a suitable subsoil and the second, on which almost greater stress must be laid, is a careful and intelligent management. Every farmer knows that an ordinary farm in order to prove successful must be well managed, much more so is this the case with a sewage farm on which the sewage must be purified all the year round independent of seasons and crops. It has often happened that after a sewage farm has been well laid out it has been handed over to the authorities, who not in the least understanding the difficulties of the case, and not wishing to trouble much about it themselves have appointed a very second-rate man, who had attempted to manage it after some rule of thumb fashion. The result could not be otherwise than disastrous, and the wonder is not that some sewage farms have failed, but that a far greater number of them have not failed. A sewage farm must be likened to a piece of complicated machinery that requires great care and skill in handling, otherwise it is sure to break down.

It is sincerely to be hoped, that in future more importance may be attached to the management of sewage farms, and to the proper and systematic education of sewage farm managers. In this respect the matter is well worth the attention of County Councils as they can adopt no better means of ensuring success than by taking the education of the future managers in hand themselves, and by closely watching the operations of the sewage farms in their counties. Indeed it has been stated and very properly too, that this matter is a question of national concern, and that the Board of Agriculture should through its inspectors exercise a close surveillance over all sewage farms. This appears all the more necessary in times when year after year vast tracts of land are passing out of cultivation.

PRESENT STATUS OF SEWAGE IRRIGATION.

In this country the importance which the Local Government Board attaches to sewage irrigation may be gathered from the fact, that it does not sanction, as a rule, a loan for the chemical treatment of sewage, without a sufficient quantity of land being obtained and laid out for the treatment of the effluent. In its opinion the chemical treatment does not remove a sufficient quantity of the dissolved organic matters, and as they must be abstracted, so as to prevent the pollution of streams, further treatment on land is necessary.

But perhaps in no other country have sewage farms made more progress than in Germany.

The largest of all the German sewage farms, and indeed of all the sewage farms of the world, are the Berlin sewage farms. Berlin had on the 31st March, 1893, a population of 1,662,114, and the sewage farms, which were commenced in January, 1876, with an area of 2,026 acres, have without interruption been extended to meet the requirements of the City, until they have now reached (31st March, 1895) the huge total of 22,881 acres. Since the 1st day of January, 1876, there have been treated on these farms 143,809 million gallons of sewage,* and the City Authorities have spent on the farms alone, up to the present time, a little over £1,700,000, of which sum a portion has already been repaid.

It is interesting to note that four convalescent homes, (two for general patients and two for tuberculous patients) with 276 beds have been established on the Berlin farms, in which, according to the reports of the respective medical officers for the district, 2,077 persons were treated in 1895. The use of these homes increases from year to year, and the results obtained are very encouraging.

Besides the remarks already made as to the prevalence of typhoid fever, it should be stated that during the twelve months ending 31st March, 1895, only one death from this disease was recorded on the farms.

Before Berlin decided in favour of sewage irrigation, a system of chemical treatment had been proposed, but as this met with considerable opposition, the City Authorities decided to carry out a series of most elaborate investigations with a view to settle the question, which treatment ought to be adopted for the purification of the Berlin sewage. These investigations which extended over about fifteen years, were carefully reported upon in thirteen volumes, and were concluded in 1872 by a general report of Professor Virchow, in which, after carefully reviewing the then state of the question, sewage irrigation was recommended. His report has been carried out, and to-day Berlin has demonstrated the success of sewage irrigation on a very large scale.

The situation of the farms towards Berlin and towards other neighbouring centres of the population, is shown in the plan facing page 484, which is taken from the 1888 report of the Committee of the Senate of the French Republic.

Breslau, a town with 350,695 inhabitants, has next to Berlin the largest sewage farms in Germany, which were commenced in 1878 with an area of 1,554 acres, and have gradually been increased until they have now reached, by the purchase of another 1,873 acres, the total area of 3,427 acres. In the last report on the extension of these farms, the following interesting statement is contained :—

The cost (yearly working expenses and payments for capital expenditure) per head of the population for chemical precipitation was in Frankfort-on-the-Main 1·22s., in Wiesbaden 0·68s., in Halle (without excreta) 0·80s., and in Essen (without excreta) 0·56s., whereas the cost of purification on land by broad irrigation amounted for the same unit in Breslau to only 0·44s., of which sum 0·22s. is chargeable to the pumping of the sewage. It is clear from these figures that the sewage of Breslau is considerably cheaper purified than the chemically-treated sewage of the other towns named, and that by adopting this system the city authorities are saving the ratepayers every year very considerable sums.

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* 143,809 million gallons equal 642 million tons of sewage.

The first city on the Continent which established a sewage farm was Danzig, where in 1869 a farm of 1,236 acres was laid out for this purpose. Since that year the works have been in continuous use, and have always given complete satisfaction. Danzig has now a population of 123,690.

Freiburg in Breisgau—a town with about 55,000 inhabitants—purifies its sewage since 1890 on a sewage farm of 1,231 acres. Although the farm was at first strongly criticised, the results obtained by this treatment have been so satisfactory that it has now been decided to lay out further portions of the land already purchased for sewage treatment.

The City of Brunswick, which has about 100,000 inhabitants, has, after a great many difficulties, just completed the laying out of a sewage farm of 1,211 acres, and as the history of the sewage question in this town is very interesting and instructive, a few remarks concerning it may not be out of place.

After a great many proposals had been made the city authorities decided in 1887 to establish an experimental station for the chemical treatment of a portion of the town sewage. The results, however, were not considered satisfactory by the Government, which, in consequence, refused to give its sanction to this mode of treatment. Thereupon the City was compelled to consider the question of sewage irrigation, which again occupied several years, and a final settlement in favour of this treatment was only brought about in 1894, after the German Imperial Board of Health, through its medical inspector, Dr. Ohlmüller, had favourably reported upon the land scheme. This report deals very exhaustively with the whole question of sewage treatment, and is well worth a careful study.

Magdeburg, with a population of 226,410, is just about to complete the laying out of a sewage farm of 2,471 acres. The town is situated on the River Elbe, which carries a considerable quantity of water at all times, but as the Government would no longer allow the discharge of crude sewage into it, the city authorities were compelled to purify the sewage, and this they ultimately decided to do on land.

Dortmund established chemical precipitation works for the treatment of its sewage in 1880, but the effluent was so little satisfactory that the town authorities are now compelled to further treat it on land. The population of Dortmund amounts at the present time to about 90,000 persons.

At Wiesbaden—the well-known watering place—the lime treatment has completely failed, and although the works have only been established a short time, the authorities, with a view to further avoid pollution of the stream which takes the effluent, are now about to conduct the latter in a cast-iron pipe line direct from the chemical works to the Rhine. The town has about 70,000 inhabitants.

Leipzig, which has a population of 397,860, is, according to the latest reports in the daily papers, again considering the question of sewage irrigation, although it abandoned this idea once and awarded three prizes for the best chemical scheme.

At Vienna, the capital of Austria, which has a population of 1,315,000, the authorities are in favour of utilising the town sewage on land and a committee of the Board of Agriculture has expressed itself strongly in favour of this treatment.

But, perhaps, in no other town has of late years the consideration of the best means of sewerage and sewage disposal led to so many public and private debates as in Paris, where these questions have been very hotly discussed until quite recently.

Paris has a population of over two and a half millions and although provided with sewers, employed up to now various forms of the conservancy method for the removal of all fœcal matters. No doubt it was at first thought that such an arrangement would admit of the contents of the sewers being emptied into the Seine, but pollution soon set in and in the year 1872 a portion of the sewage was for the first time utilised on 126 acres of land at Gennevilliers belonging to private owners. This treatment proved very successful and the area under sewage was from time to time enlarged until it has now reached a total of 1,945 acres. But as the land at Gennevilliers belong to private owners, is comparatively near to Paris and of limited extent only, the city authorities endeavoured to take the whole of the Paris sewage further down the Seine with a view there to purify it on land. However, for a long time they were not successful in obtaining the necessary parliamentary sanction for this course and it was only after the law of the 4th April, 1889, had been passed, that they could proceed in this direction. The next great step in the sanitary history of Paris is the law of the 10th July, 1894, which made the water carriage system compulsory for the town, and clause fifteen of the bye-laws issued by the Prefect on the 8th August, 1894, renders the insertion of the disconnecting trap between house drains and street sewers obligatory. The authorities are now constructing an aqueduct of about nine miles in length from the pumping station at Clichy to the neighbourhood of Achères, where they have purchased 1,975 acres for sewage treatment. This scheme is so designed that the aqueduct can, when necessary, be continued further down stream so as to open up fresh areas for sewage irrigation.

From these remarks it follows that after a long and severe struggle, in which even M. Pasteur took part at one time as an opponent of the land treatment, the water carriage system pure and simple and sewage irrigation have been carried in the face of formidable odds.

The plan facing page 484 shows the position of the farms at Gennevilliers and in the vicinity of Achères in their relation to Paris and the neighbouring centres of population; it is taken from the 1888 report of the Committee of the Senate of the French Republic.

Concerning North America it is no doubt well known to the members of The Sanitary Institute, that the very excellent researches made at the experimental station at Lawrence of the State Board of Health for Massachusetts have led to an increased interest being taken in these questions and the following are some of the towns which have adopted the system of land purification:—Lenox, Amherst, Medfield, Framingham, Marlborough, Gardner, Westborough, and Brockton.[1]

RECENT OPINIONS ON SEWAGE IRRIGATION.

It has already been stated that Pasteur at one time held opinions opposed to the purification of sewage on land, which were derived from his scientific researches, but that towards the end of his life the great savant—as is generally believed—somewhat modified his views on this point.

Professor Virchow, of Berlin, who as a member of the Berlin town council is intimately connected with the Berlin sewage farms, holds that sewage farms are in the interests of the public health desirable and excellent institutions.[2]

Professor Koenig, who is the director of the agricultural experimental station at Münster and who, as a chemist, has

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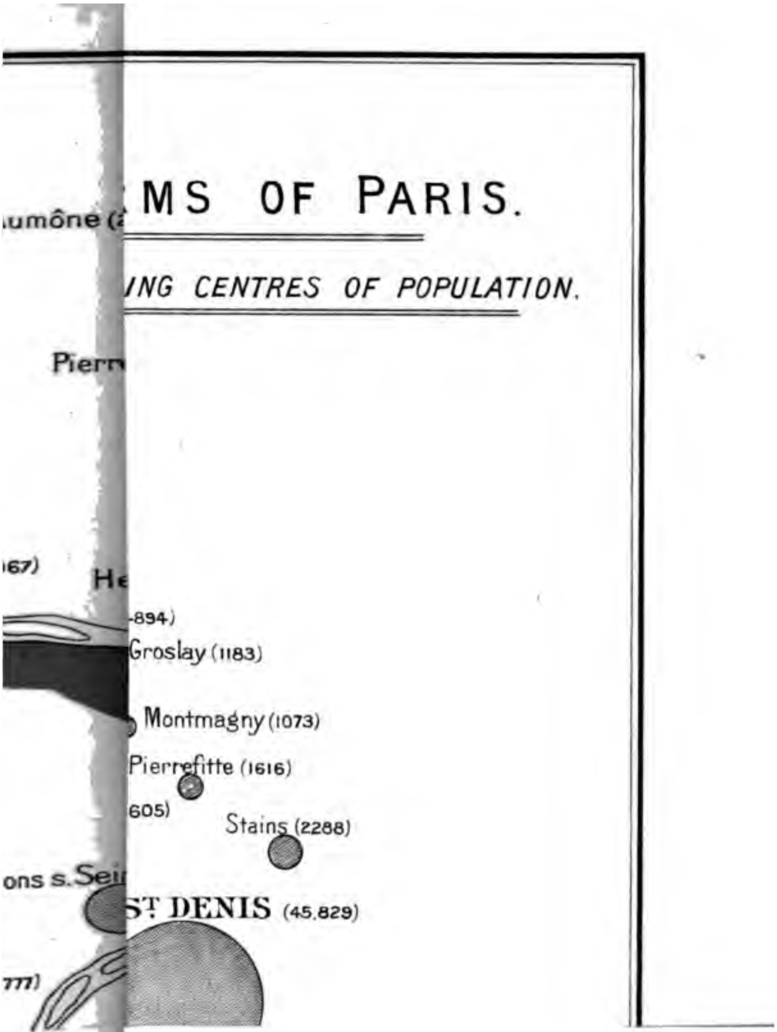
[1] See Report of the State Board of Health for Massachusetts for 1892, page 557.

[2] See Th. Weyl's Paper:—Beeinflussen die Rieselfelder die öffentliche Gesundheit? page 6. Berlin, 1896.



…MS OF PARIS.

…ING CENTRES OF POPULATION.

given this matter his most careful consideration for years past arrives in his well-known book on the pollution of rivers at the following conclusions :—[1]

"The most perfect purification of foul liquids containing nitrogenous organic matter *can, i.e.*, if done *correctly* be brought about by irrigation. (By this I do not mean to say, that for instance sewage irrigation is the only and most rational way of purifying and utilising fœcal matters; this entirely depends on conditions of locality and time; the most suitable disposal of fœcal matters is a question which I cannot touch upon at this point.)"

"Generally speaking, through chemical and mechanical means of precipitation or purification only the *suspended* matters can be removed; for just as little as we possess effective means for the precipitation of ammonia and potash, just as little do we possess such means for the removal of the *dissolved* organic matters. The precipitation of the dissolved organic matters can only to a limited extent be assisted by chemical agents of precipitation."

Very much to the same conclusions as Professor Koenig came Allen Hazen, who investigated this matter in 1889 for the State Board of Health for Massachusetts.[2] He states, that in addition to the suspended matter from 22 to 41 per cent. of the dissolved matter were removed from the sewage by the chemicals (lime, copperas, ferric sulphate, and aluminium sulphate) employed by him, and in concluding his report he remarks :—"It is quite impossible to obtain effluents by chemical precipitation which will compare in organic purity with those obtained by intermittent filtration through sand."

Mr. Dibdin, the chemist of the London County Council, expressed similar views in the discussion of the author's paper on the Berlin Sewage Farms, he remarked:—"Where sandy soil could be found for sewage irrigation, that method was no doubt the best. Ordinary precipitation processes, as he had before the honour of showing to the Institute (of Civil Engineers), would not remove more than a certain amount of the organic matters in solution." [3]

Dr. Dupré is evidently of the same opinion, for in the discussion already quoted, he stated:—"He knew no one familiar with the subject who denied that the most effective treatment of sewage was by passing it through land, provided the land was suitable."[1]

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[1] See Die Verunreinigung der Gewässer von Dr. J. König, page 74. Berlin, 1887.

[2] See Report of the State Board of Health for Massachusetts for 1890, page 784 and seq. Boston, 1890.

[3] See the Berlin Sewage Farms, by H. Alfred Roechling, page 233, Proceedings of the Institution of Civil Engineers, Vol. CIX., Session 1891-92, Part III.

Concerning the views held by Dr. Edward Frankland and the Local Government Board, it need hardly be repeated here that they are in favour of the purification of sewage on land.

The well known bacteriologist, Professor Carl Fraenkel, who has carefully examined these questions, states in an article on "Water Filtration and Sewage Irrigation," as follows:—"In principle, therefore, the exclusion of all noxious matters from our watercourses is to be energetically insisted upon, and as the best means for obtaining this end, sewage irrigation must be recommended."[2]

CONCLUDING REMARKS.

Innumerable further quotations might be made, but the few opinions mentioned will suffice to show, that of all methods of sewage treatment, sewage irrigation occupies a very prominent, if not the most prominent place, and that both leading bacteriologists and chemists have pronounced in its favour.

If the author be permitted to add his own testimony, he would like to say, that he has always been in favour of sewage irrigation, where the local conditions favoured this course, and he is glad to be able to state, that at Leicester a sewage farm of 1,700 acres on stiff clay and with steep falls, the laying out of which was designed by the late Mr. J. Gordon, has proved very successful under the direct management of a Committee of the Town Council. In proof of this the author would mention, that the Leicestershire County Council, which at first raised various complaints about the nature of the effluents, congratulated the Town Council in its last yearly report on the efficient way the sewage had been treated on the farm.

Whilst the author does not wish in the least to discourage other methods of sewage treatment, he believes to have shown that a one-sided condemnation of sewage irrigation is not supported by general established facts, but that on the contrary these facts are strongly in favour of the application of sewage to the land. In this respect he may be permitted to quote from a former paper of his, in which he stated:—"Much has been said and written for and against sewage farms, and the question whether chemical treatment or application to land is the better way to dispose of sewage has been fiercely discussed. The battle is still raging, though its din may perhaps be a little more distant, the public at large having grown weary of arguing this matter with no apparent likelihood of arriving at a satisfactory conclusion. The author is of opinion that there can be no general solution of this vexed question, and that a great mistake has been made in the past by over zealous advocates of the one or the other method, each party considering their own remedy to be an unfailing one in every case. These enthusiasts have thought that a success obtained in some particular case under special conditions could be anticipated under all circumstances, forgetting that like causes may not produce like results, if the conditions under which they have to work are not the same. The question is not so much whether sewage-farming or chemical treatment is theoretically the right way to dispose of town sewage, but rather whether in a particular case the one method is more likely than the other to give good results, as every case requires to be dealt with on its particular merits."

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[1] See the Berlin Sewage Farms, by H. Alfred Roechling, page 242, Proceedings of the Institution of Civil Engineers, Vol. CIX., Session 1891-92, Part III.

[2] See Wasserfiltration and Rieselwirthschaft by C. Fraenkel. Hygienische Rundschau Januar, 1896.

[*This discussion applies to the Papers by* MR. HERBERT H. LAW, MR. HENRY LAW, *and* MR. H. A. ROECHLING.]

Col. JONES, V.C. (Finchampstead), said with regard to Mr. Herbert H. Law's paper, that it described a most ingenious invention, likely to be useful in the way of applying precipitating chemical agents to the varying quantity of town sewage. He had on many occasions brought the want of such means of adjustment as an argument against the efficiency of precipitation works generally, from his practical knowledge of the extreme variety both in quantity and quality of the sewage to be dealt with. He had always complained of the difficulty of putting it into practice on a large scale. This ingenious arrangement, although it was complicated, appeared to him likely to work admirably, and to supply a great want where it was necessary to resort to precipitation. He then passed to Mr. Roechling's paper, which he hoped the members of the Institute would read carefully and study, because it was a mass of arguments against prejudice, which was most fatal to a right understanding of the sewage question in England. It appeared to him very ungrateful to find that all the pains that had been taken thirty or forty years ago, and since, in England, to work out the real facts about the sewage question, had been neglected and passed over of late years through simple inattention and want of management of what they knew was the right thing. The Germans and the French had taken from us all the information, and had carried their works out systematically and properly, and with good results in consequence. He would draw attention to one point which was not mentioned in the paper, but which was arrived at from the accounts of the Berlin Municipality, and it was with regard to the manual labour of spreading sewage on those farms. It was that—taking a million of gallons per day of sewage—they pay fully three times the amount which he knew to be so expended on the best managed sewage farms in this country for spreading an equal volume of sewage. He did not think labour could be more expensive in Germany than in this country, and he attributed the better results in Germany to the high amount of labour expended on the actual spreading of the sewage over the land. The essential thing to practical men was that when the sewage was taken to the land it must be properly distributed, and therefore he thought that it was one of the most important points they could bear in mind in regard to this paper. Then he came to this prejudice which was everywhere opposing great difficulties to the proper systematic irrigation of sewage farms. M. Pasteur was an acknowledged authority, but he would like to point out that by 1889 he (M. Pasteur) had dropped the theory referred to in the paper. He had made careful investigations for certainly ten years or more before he dropped his old theory, which was only the theory of prejudiced people, viz., that to spread the germs of typhoid and other diseases about the land was a danger connected with sewage irrigation. They knew that in England, with all the badly-managed farms, no case of disease arising from germs in this way had ever been traced out, even in connection with the worst-managed sewage farms. He congratulated Mr. Roechling on his admirable paper, and he hoped it would be thoroughly studied.

Mr. E. G. MAWBEY (Leicester) said that this sewage farm at Leicester had been referred to in Mr. Roechling's paper, and it was referred to recently by a very able engineer as a great object lesson of success achieved on a clay farm under great difficulties. His very able predecessor, the late and much esteemed Mr. Gordon, had designed the main intercepting sewers at Leicester, the pumping engines, the rising mains, and the main carriers, and he (Mr. Mawbey) had had the honour of carrying out most of those works; but the preparation of all the land, the laying out and drainage of the farm and the carriers for about one-half of the farm had been designed and carried out by the speaker, which was about seven years ago. This scheme, in consequence of the density of the clay soil, was not advised by his predecessor, but it had been forced upon him on account of the great difficulties in obtaining the better kind of land which Mr. Gordon had recommended; and he therefore undertook the work with a very heavy heart. As it was clay land, and because it was considered impossible to go on successfully with the agricultural operations without sub-drains to drain the farm in the ordinary way, a scheme had been prepared before his time with all the sub-drains connected with the trunk drains and the brooks. Then the great difficulty which occurred to his mind was, that if in draining in that way a clay farm which only had a foot of top soil as filter sewage cannot be filled in a less depth than about six feet of soil, it followed that the sewage would find its way into the sub-drains, foul, and go direct to the river. It was therefore prophesied all round that the Leicester farm would be a failure, and he was strongly advised by his friends to have nothing to do with it. However, he took it all in hand, and studied the question a great deal. Suppose the glass roof of a room to be the farm, and the ridge of the roof to be the watershed of the farm, the gradients or slopes of the farm being pretty steep, the sewage was sent up into the small receiving tanks in the centre of the farm. On this watershed there was a main carrier right through the farm, and then there were other main carriers going down subsidiary watersheds each way. The first idea he had, and which was adopted, was to "break up" by the side of the main carriers all the pasture fields into arable fields, and where the lower fields of the slopes were arable land to seed them down into old pasture or sow rye grass; the idea being to first have arable land to send crude sewage on to, and finish it off on the old pasture. He dealt with the farm in fields as he found it, instead of "stocking up" the hedges. There were now 1,700 acres of land, 1,400 acres of which were sewaged. He had the whole of the dykes deepened to not less than four feet, and some five feet, so that he could form a sort of natural drainage of all the fields to begin with, and that all these ditches should form the effluent drains. A great many of these fields were already drained about three feet deep for agricultural purposes, but this was not sufficient for their purpose. Now what he did—instead of carrying out the original proposal to have a complete system of drainage with all the sub-drains of fields to go into the master-drains, the master-drains to go into the trunk-drains, and all to go direct to the water-courses—was to take each field and deal with it separately. He laid a new master-drain along the bottom of each field to intercept the existing and the new branch-drains, and carried it to the lowest corner of the field, and then ran a free outfall-drain from it on to the surface of the next field as quickly as he could get it out. That was run down by the side of the dyke. At this free outfall he made a little chamber with one outlet and valve leading on the surface of the field, and another to the dyke. Then, at the bottom of the next field, he did the same, and at the bottom of all the fields. It sometimes happened that he could not get on to the surface of the very next field, but he missed one and got on to a lower one. The result had been, as he anticipated, that when the drain effluents came out at the bottom of the upper fields they were not fit to send away. So he sent them over the next lower fields, and so he had been able to turn the effluent from the drains either over more land to treat it over again, or, if it was fit, to send it into the nearest dyke. This has been the chief means of the success of this farm. They had been able to send away a thoroughly good effluent. He also adopted the well-known system of putting on the surface effluent over and over again, and he had with these several arrangements no difficulty whatever in making the Leicester clay farm a success in purifying the dense sewage from nearly 200,000 people for six years past. There was one other point that was of great importance. He had a great deal of opposition to this scheme, just at first, till their present chairman (Alderman Sir Thomas Wright) championed him; so that the report was carried, and he was afterwards well supported by the committee. Another difficulty had been whether the bailiff should do the sewaging or whether he should direct it. The bailiff was a grand farmer, but he had not then had so much experience in sewage farming. Sir Thomas Wright got the committee to pass a resolution that until the farm was all laid out, and they had got into thorough working order, he should not only be the engineer, but be head over the farming and sewaging operations. He held that position for nearly three years, until it was proved without a doubt that he could succeed. The bailiff, being a very able man, grasped the situation, and he (the speaker) then reported to the committee that he wished to be free from the sewaging operations; and the bailiff (Mr. Thurston), together with a model committee and their able and energetic chairman and vice-chairman (Alderman Sir Thomas Wright and Alderman Collins), now managed it in a highly satisfactory manner. With respect to Mr. Law's paper, his ingenious arrangements appeared to be just what was wanted to make the supply of chemicals fit the ever-varying flow of sewage, and also the varying quality of the sewage, which changed very much throughout the day in manufacturing towns.

Mr. DAVID BALFOUR (Newcastle-upon-Tyne) said that with regard to the two papers that had been read by Mr. Herbert Law and Mr. Henry Law, he had great pleasure in complimenting those gentlemen on their papers. Mr. Henry Law's name in sanitation and civil engineering was known all over the country. As regards the subject of sewage irrigation or other treatment, he thought that the paper which had been prepared by Mr. Roechling (whom he had the pleasure of seeing occasionally, and who he was sorry to hear was not able to be present) was a very excellent paper indeed, and very comprehensive. He had lately had the opportunity of visiting the sewage irrigation and intermittent land filtration treatment at Paris, and also an opportunity at a Congress at Glasgow about a month ago, of examining another mode of treatment there, both being respectively excellent and successful examples of what could be done in regard to the purification of rivers, whether inland or tidal. The pollution by our City of Newcastle of our noble river Old Father Tyne could be similarly prevented by taking a lesson out of the book of Old Father Clyde at Glasgow, or the Thames at London. Referring to Paris for a little, the sewage of that city, after delivery by gravitation, and also "elevation," as the French call it (being pumped to a height of forty feet in Clichy), was conveyed on to excellent land farther on at Grenvilliers. At present about 2,000 acres were used for the treatment of the sewage, and it was altogether very successful. He visited the City Engineer Monsieur Bechmann, whom he had met previously, and who kindly accompanied him there. The treatment was similar to that at Berlin, and the land was of a very open character. It consisted of a gravel sub-soil overlaid by a sandy loam. The treatment of the whole of the sewage was not effected there. Before reaching the farm he visited the main sewers of Paris. They were about ten feet in width and height and arched over, and were not a very great distance beneath the surface of the streets, and they were, as he saw in new extensions, generally made without interrupting the street traffic by surface excavation. He was told that about 780 men were continually at work cleansing the sewers; and so far as those men and frequent visitors (both ladies and gentlemen) to the sewers were concerned, no disease or complaints had been traceable thereto. Water mains for duplicate supply, also pipes for compressed air, telephone and telegraph wires were accommodated in the sewers. The sewage flowed along in a constant fresh-looking stream. There was no chemical treatment of it at any stage, neither in the sewer nor on the farm. The exploration of the larger main sewers was effected by an electrically-drawn launch and elegant boats. Reaching the end of the outfall sewer they inspected the farm, which comprised 2,000 acres. The sewage was distributed by various methods, particularly the ridge and furrow system, and surface irrigation. Most of the land treated was in the hands of the Authority. Part of the sewage, however, was given to tenants of the adjoining land where it was usefully and successfully employed. The under-drainage necessary was of a very partial character, being chiefly to concentrate the effluent and bring it to a common discharge into the river Seine. They found the effluent water without colour, taste or smell; the effluent brook was very clean, there was no deposit whatever, and it was very clear and limpid. He observed there were small minnow fishes in the stream as well. The management of a sewage farm was a very important matter; as important indeed as the construction, and design. As a matter of fact the management was quite half the battle. It was very important that no sewage works whatever should be let to tenants, their object being naturally profit, rather than purification. He thought we had arrived at a point when sewage purification was altogether, broadly speaking, a well solved and settled problem, and that authorities need not keep back for want of that. Of course they knew they had to have a great many meetings to consider "how not to do it" before it was done.

Dr. SYMONS (Bath) said he understood a gentleman to say that no evil result followed the spreading of typhoid germs on land. He did not think that it was quite in accordance with facts; he should have said the spreading of dead typhoid germs on land did no harm. It was generally thought that typhoid germs soon perished in sewage, and were, therefore, dead when they reached the farm; with recent excrement, containing living typhoid germs, it was very different. Returning sewage to land was, undoubtedly, the most natural method to adopt; but, unfortunately, it was not always easy to get the necessary land, and the Regulations of the Local Government Board did not make it any easier. Under some circumstances the "septic tank" of Mr. Cameron, City Surveyor of Exeter, seemed worthy of trial, and he was sorry not to have heard that system discussed at that great meeting. Mr. Cameron's process was now under trial working at Exeter and at Yeovil; the results would be followed with interest.

Mr. **Rogers Field** (London) said the observations of Mr. Mawbey seemed to him to be very important. They were told by all the authorities on the disposal of sewage by irrigation to "get suitable land." Well and good; but if the land was not suitable, what were they to do then? That was the problem which engineers and sanitary authorities had often to solve: and towards its solution Mr. Mawbey had, he thought, taken a great step in advance. Suppose, as was often the case, that they had clay land which was suitable for the disposal of the sewage in every respect except that it was clay land; if anyone could show how that could be made effectively to purify the sewage he would be a public benefactor. The problem was not to be solved by a trial on two or three acres, but only by trial on a large scale, as Mr. Mawbey had carried out at Leicester. The question of Leicester sewage happened to be peculiarly interesting to him. More than forty years ago he was a pupil of Mr. Thomas Wicksteed, the eminent engineer, who carried out at Leicester a system of sewage precipitation by lime and he had to do with the details of the work. It was the first time the process had ever been carried out on such a large scale. The work was undertaken by a company and it was estimated that there would be a large profit. The company however failed, and the town had to take over the sewage works. The precipitation process did not sufficiently purify the sewage. Eventually the town had to come to a sewage farm, and to take the unsuitable clay-land Mr. Mawbey spoke of. He believed that the way Mr. Mawbey had dealt with this land was absolutely the right way, and he had done the same sort of thing himself on a small scale. It must be remembered that they must under-drain the clay land for agricultural reasons, but instead of letting the main under-drain discharge into a ditch or river, as was generally done, they must be made to discharge on to the surface of the land at the nearest place the levels would permit. Then, if they could let the under-drains from this lower land discharge again on to the surface of the land, by this means they would obtain a pure effluent. But the process could be carried a little further than had been done by Mr. Mawbey. If there were not sufficient land on which to turn the effluent a second time, they could construct an artificial filter of burnt clay to discharge on to it. This would add to the expense, but be cheaper than chemical treatment. He quite agreed with Mr.

Mawbey as to what he said about the management. Whatever was spent in laying out sewage land, it would be all thrown away if the management was not under skilled scientific supervision. It was too much the custom to leave the whole matter to the farm bailiff, who would think much more about the crops than he would about the purification of the sewage.

Mr. J. E. **Parker** (Fence Houses) said that the references in the papers had been to sewage disposal works for large communities. It was well known, however, that small communities had found themselves in great difficulties with regard to the question of sewage disposal, and, therefore, that was his excuse for rising, for he had to do with small communities. Speaking of the ingenious contrivance they had had before them of the chemical feeder, he thought it said a great deal for the ingenuity of the designer. There appeared from the diagram to be one little defect, and unless made of something that was not metal there would be considerable difficulty, because he found that allumino-ferric attacked even brass and gun metal. He quite agreed that the efficacy of a sewage farm depended on the management. He would also say with reference to sewage farms that there was a sentimental objection to them, and that objection had the effect of producing a depreciation in the value of the property which surrounded them. He knew a case in which a Parish Councillor was the sewage farm manager, and he happened to know that this Parish Councillor raised at the Parish Council meeting the question about the depreciation of the property. He said he had lived there himself and suffered no harm, but still a person objected to living in a house which was near a sewage farm. He thought these sentimental objections had to be considered.

Mr. **Henry Law** (London) said that without endorsing fully the observations made by Mr. Mawbey, he thought they would find as he progressed that the land would become better and better. They were quite aware of the effect of the action of allumino-ferric on iron, and the tanks were made of timber, lined with lead.

Dr. J. H. **Garrett** (Cheltenham), as a chemist and Medical Officer of Health in that meeting of engineers, would say that the remarks he had just heard expressed in support of the broad irrigation system of sewage disposal were rather too enthusiastic, and he was sorry to feel obliged to put a little sprag in the wheel. He did not know whether all the gentlemen who had spoken had considered the condition of the effluents and of the water-courses receiving the effluents from broad irrigation sewage farms. From his point of view he could not say that he had often found them satisfactory. He thought the Borough Engineer of Leicester was very much to be congratulated upon having satisfied his Council. County Councils throughout the country were at present very far from being satisfied as to the effluents from sewage farms, and particularly from the broad irrigation farms. In Leicester and such large towns there were at the disposal of the Council, gentlemen with great experience and ability, but in the smaller towns the services of such able men were not always available. And in regard to the management of sewage farms he was afraid that they were not always so well managed in the smaller towns as in Leicester. Generally speaking there was a great amount of carelessness exhibited in the application of sewage to land. In regard to the inspection of sewage farms he thought it was anything but well done. In the smaller towns almost anybody was appointed inspector of the sewage farm. The inspector walked round casually, and occasionally the committee, accompanied by their inspector, visited the sewage farm, and matters were reported to be very satisfactory. In a general way the inspector was a person who was quite incompetent to be inspector and to see that the sewage was being properly applied, whereas the importance of his duties could hardly be exaggerated. He had heard it stated that day that the borough engineer was the proper person to have the management of sewage farms, but he knew that frequently the borough engineer had a great many duties to perform, being an extremely busy man, and in some instances perhaps sewage farm management required a good deal of time. Sometimes in the smaller boroughs, sewage was run on to land which did not belong to the authority and which was not controlled by them. An agreement was entered into with the neighbouring farmers to receive sewage. This was a very bad plan and always resulted in great pollution of the water-courses.

Major LAMOROCK FLOWER (Lee Conservancy Board) thought that perhaps three or four words from him would not be entirely thrown away, seeing that for the last twenty-five years he had had plenty of opportunities for observing how sewage had been treated, and also of treating it to a very great extent. With regard to Mr. Herbert Law's paper, the use of chemicals in solution had been employed by him with very considerable success, but we were indebted to the author for the very excellent scientific mode of automatic application which had been exhibited to them, for in all their sewage treatment they had to deal with an unfortunate condition, which was, the fallibility of human nature. As to the management, or rather mismanagement, of sewage farms, he would say that, without exception, the failure in treatment of sewage on land was absolutely due to mismanagement. There was one other thing which perhaps sometimes leads to mistakes, and that was not allowing a scientific man to look after the work, but in dealing with it through committees. It was a hard thing to say, perhaps, but he would refer to one very clever remark made some years ago with regard to committees: "If the children of Israel in their passage through the wilderness had been governed by a committee instead of a leader, they would probably be wandering about the wilderness to-day."

Mr. H. ALFRED ROECHLING (Leicester), replied in writing to the discussion as follows:—"The subject of the purification of sewage is such an important one that I think any information or any discussion throwing light upon it ought to be hailed with satisfaction, and if I have succeeded in doing this, even though it be to a small extent only, all my labours are well repaid. I am much obliged to Mr. Mawbey, the present Surveyor of Leicester, for affording me an opportunity of making a few remarks about—may I use that term—a very old acquaintance of mine, the Leicester Sewage Farm, which I have known intimately long before Mr. Mawbey was ever thought of as successor to the late Mr. Joseph Gordon. Indeed I have known this farm from the period, November 1884, when it was first thought of as a sewage farm for Leicester down to the present moment of penning these lines, whereas, to judge from his remarks, Mr. Mawbey has been connected with it "for nearly three years" only, at the end of which he voluntarily resigned his position as Engineer and Manager. Since then, so we must conclude, the farm has been managed by a Committee of the Leicester Town Council, whose Chairman and Vice-Chairman are Sir Thomas Wright and Mr. Alderman Collins, and whose Bailiff is Mr. F. Thurston. It is correct, that when this site was first mentioned for a sewage farm, the late Mr. Gordon did not like it so well as other sites which were in his opinion more eligible though the expression "with a heavy heart" appears to be beside the mark. This can hardly be surprising when we consider that the land at Beaumont Leys is heavy clay land, and that the sewage has to be lifted over 170 feet high; indeed, I don't think any engineer worth that name would have spent the ratepayers' money without any misgivings upon such a venture! When, however, this site was adopted Mr. Gordon was determined to do all in his power to make the farm a success. When Mr. Mawbey took up his duties as Surveyor of Leicester, at the end of October 1889, the plans for the laying out of the farm were complete, and the first contract all but finished. This contract comprised the tanks, the main and subsidary carriers, the pipe carriers, the effluent water culverts, and a road for practically two-thirds or 850 acres of the then extent of the farm of 1,375 acres. The total amount of the tender was £14,351 9s. 6d., and according to the certificate of the 18th October, 1889, the works carried out to about within a fortnight of this date came to £11,028 9s. 11d. Some minor deviations have been made in laying out the remaining one-third portion of the farm, but that perhaps cannot be surprising. As to utilising the effluent from the higher lands on the fields lower down the slopes, this was always kept in view by the late Mr. Gordon, and with a view to convey some information concerning this point to him he asked me to visit the Rugby Sewage Farm, where this principal had for many years past been adopted by Mr. Baldwin Latham. Besides, it is so well known, that at Wimbledon too, this double system of irrigation is carried out, and, further, the considerations which lead up to it are so exceedingly elementary, that I need not say here another word concerning the engineering features involved in it However, it would in my opinion be a great mistake to assume even for a moment, that the favourable purification results, obtained on the Leicester

Sewage Farm, are due to this double irrigation. Such an assumption is against what are now known to be the laws of purification of foul liquids. This purification is brought about by bacteria, and it is well known that they carry on their work most efficiently in the presence of a sufficient supply of oxygen, hence, it is a fact that purification proceeds most actively in the pores of an open soil near the surface of the land, but not in dark conduits such as underground pipes, &c. All that can, therefore, be said of the system of double irrigation is that it is a means to the end, not the end itself, and it is most important not to lose sight of this. This being so, there can be but little doubt that the favourable results obtained at Beaumont Leys are mainly due to the management of the farm, and here I think it is but fair to say, that had it not been for the untiring energy of Sir Thomas Wright, the never failing zeal of Mr. Alderman Collins, and the painstaking efforts of Mr. Thurston, the Leicestershire County Council would have spoken out before now with no uncertain voice, as it did formerly. In conclusion I should like to say that the work on the farm is by no means complete, and that the Committee go on with their drainage and other operations from year to year. Indeed, it would be surprising if all the work on so large a farm had been completed in comparatively a short time. It is the essence of a careful management to systematically study for a number of years the behaviour of clay land under sewage, and then to treat it by draining and other operations in the manner which benefits it most.

"*River Pollution*," *by* PROFESSOR HENRY ROBINSON, M.Inst.C.E.

(FELLOW.)

IN my address as President of this Section at the Congress held in Newcastle in 1882, I stated that "As the various difficulties which existed a few years ago in regard to the purification of sewage have now been diminished by the further knowledge that has been gained, it may be reasonably expected that the Rivers Pollution Prevention Act of 1876 will be made more operative than has hitherto been the case." In the following year I again brought the question of River Pollution before the Congress which was held at Glasgow. The discussions on those papers showed that the necessity was then well recognised for a modification of the Act, to prevent its being (as it was), practically inoperate. It remainded without change, however, until the year 1888, when the Local Government Act was passed, which gave County Councils power to enforce the River Pollution Prevention Act of 1876, and which also enabled the Local Government Board to form joint committees to deal with river pollution. In 1892 the Mersey and Irwell Joint Committee obtained an Act, and this was followed in 1894 by the West Riding of Yorkshire Act, by which powers were conferred upon authorities to prevent river pollution who might be better expected to enforce the Acts than was previously the case.

The Rivers Pollution Prevention Bill which was introduced in the House of Commons last Session, extends to County Councils, Joint Committees and Rivers Boards in England, the main provisions of the Mersey and Irwell Act of 1892, and of the West Riding of Yorkshire Rivers Act of 1894. It also prevents the pollution of canals.

The Floods Prevention Bill, which was introduced in the Upper House by Lord Thring last Session, confers upon County Councils powers to cleanse water courses and to improve the channels of rivers by removing obstructions.

Both these Bills have unfortunately had to stand over to next Session, but it may be reasonably expected that in the near future they will be passed, and will lead to the present gross pollution of the streams throughout the country being abated. Having had to report upon the causes of pollution of many rivers, I have found that in the majority of cases they admit of a remedy. The main sources of pollution, broadly speaking, arise from sewage outfall works, where the system adopted is incapable of producing continuously good results, from manufacturing refuse being passed into streams as the natural vehicle for getting rid of waste products, also from trade refuse and accumulations of filthy matter being allowed to collect close to the banks, and to be washed into streams. As regards the pollutions due to defective sewage outfalls, they admit of being remedied in the light of recent experience, and by the expenditure of the necessary money to produce better results. The unsatisfactory way in which some local authorities have works of sewerage and of sewage disposal designed and executed, and the parsimonious manner in which the treatment of the sewage at the outfall is carried out, are mainly the causes of these pollutions.

Means of purifying sewage and sewage effluents are now available that were not known a few years ago, and I have no hesitation in saying that most sewage outfall works admit of modification with resultant advantages, both in simplifying the working, and improving the effluent, thus obtaining "the best practicable and available means," as stated in the Act.

The pollutions that arise from manufactories require to be dealt with having regard to the circumstances of each case.

The exercise of a little skill and care will enable many such pollutions to be abated by utilizing the waste products, and in other cases remedies can be found without involving an expenditure which would press too heavily upon the industry. A river has for so long a time been regarded as the natural way to get rid of filthy matter, whether from manufactories or otherwise, that those who have, in a *bona-fide* manner, acted upon this assumption, require some consideration in the enforcement of legislation to abate pollution. The fact, however, that, in the near future, the streams will no longer be able to be the recipients of polluting matters, has already been the means of arresting some mischief. Many are offenders from sheer ignorance. Some from a disinclination to incur expense which would lead to no advantage to themselves, whatever it might do for the benefit of others. As regards manufacturing refuse which now causes pollution to streams, I have, in my own practice, experience of cases where pollution has been arrested even with commercial advantage to the industries concerned.

The pollutions due to farm buildings, private dwellings and the like, admit of being diverted, and the filthy ditches which are cleansed by heavy rains washing the filth into the streams no longer continue. The majority of streams are so polluted, that it will take years after the causes of fouling are removed, before they return to a normal condition of purity. I believe that it will be necessary to accelerate this natural, self purifying action by artificial means, and so prevent, or rather lessen the continuance of the mischief.

With the improved condition of rivers, a large amount of much needed water will be available for town supply. Their filthy condition has unavoidably led to the exclusion of such waters from all engineering calculations in regard to water supply. With the disappearance of serious pollution this water will become available for storage. The inclusion of the bulk of flood water in reservoirs would enable compensation water to be discharged continuously instead of intermittently, at the same time that the injury arising from floods would be minimised.

The objection which at one time existed to the admission into reservoirs of waters not absolutely pure, may be regarded as steadily disappearing in the light of recent knowledge. Dr. E. Frankland (in a Paper at the Royal Institution last February) stated in speaking of storing the Thames water—"as regards the quality of this stored water, all my examinations of the effect of storage upon the chemical and especially upon the bacterial quality, point to the conclusion that it would be excellent. Indeed, the bacterial improvement of river water by storage, for even a few days, is beyond all expectation." Again, he said, that "it is not too much to expect that storage for, say a couple of months would reduce the number of microbes in Thames flood water down to nearly the minimum ever found in that water in dry weather."

In a naturally pure stream the discharge into it of filthy matters has become more and more a cause of its deterioration, one being the increase in the amount of the polluting matter, and the other being the greater abstraction of pure water from the stream to provide for a supply to the populations which require it for dietetic, manufacturing or power purposes.

The amount of the abstraction, either permanent or temporary, of water from a river for any of these purposes has been the subject of much strife, and no definite relation between the amount that can be relied upon from the source of supply and that which can be utilised has been established; inasmuch as the conditions which obtain in rivers vary considerably. Hence the controversy that generally arises when water is intended to be abstracted and stored in impounding reservoirs. This often leads to compensation water being given to a river at a lower part of it, whereby the upper part is liable to become a dry bed in periods of drought, and consequently riparian owners on the banks of the river there are deprived of water altogether.

The pollution of the rivers of this country was characterised by the late Lord Shaftesbury as a "national evil." Those who have worked, as I have, to bring about a better state of things, will not, I trust, have to wait another fourteen years before a definite step in the direction of the enforcement of legislation is accomplished.

"*India's Sanitary Needs*," *by* J. W. PARRY, Assoc.M.Inst.C.E., F.S.I.

(MEMBER.)

IT would be quite impossible to take up and discuss all or even many of the subjects embraced under this head, I therefore propose to refer chiefly to questions which concern District Boards—Unions as they are called in the Madras Presidency—and which correspond somewhat to Rural District Councils of England and Wales.

Before, however, taking up the principal points to be discussed, it is necessary to consider certain sanitary matters which concern India in general. Here I would express my indebtedness to the transactions of the Seventh International Congress of Hygiene and Demography, held in London in August, 1891; as also to the Blue Book Sanitary Measures in India for 1893—1894 which is the latest one we have received. In these transactions and in this report we have the testimony of the principal medical sanitary commissioners throughout India, as also the views of several able administrators such as Messrs. Ollivant, Ashburner and Cotton, of the Indian Civil Service; of Major R. C. Temple of the Indian Staff Corps; and lastly of several distinguished Parsi officials.

To show that the Government of India are quite aware that sanitary reforms are necessary, and are only restricted in their endeavours by the poverty of the country and the crippled state of the finances due to the depreciated rupee, I have added an abstract of the principal sanitary works already carried out up to 1891. In addition I give in a tabular form an abstract of the expenditure in all sanitary work for India during 1893—1894.

Abstract Expenditure on all Sanitary Work for India during 1893-94.

Province.	No. of Municipalities included	Total Income of Municipalities, in Lakhs of Rupees.	Expenditure exclusive of roads in Lakhs of Rupees.	Remarks.
Bengal	146	37·39	16·13	Exclusive of Calcutta and neighbourhood (9 lakhs). In 41 Municipalities nothing spent on Sanitary work.
Do. (Local)...	...	...	2·17	
Do. (Private).	...	...	3·69	
Assam	...	1·91	0·81	
N. W. P.	103	50·78	29·45	Village Sanitation Act, framed '93.
Punjab	149	40·64	6·07	
C. P.	19	16·78	2·33	Main work of Board was the direction of Village Sanitation.
Madras	55	27·47	14·53	Exclusive of Madras City and neighbourhood (10·71 lakhs).
(Do.) Districts)	...	78·93	6·27	
Berar...............	11	3·68	2·39	
Coorg	...	...	0·21	Better Conservancy of coolie lines on plantations considered.
Burma	...	...	0·81	Insufficient information supplied by Municipalities.
Bombay	...	...	0·83	Exclusive of Bombay City and neighbourhood (22·93 lakhs).
Do. (Districts)	...	...	29·0	
		Total...	114·69	lakhs of rupees.

From this table we see that the total expenditure on sanitary works all over India, exclusive of Presidency towns, was 114·69 lakhs of rupees. If we add (9 + 10·71 + 22·93) lakhs for these towns respectively we get a grand total of 157·33 lakhs, calling this 158 lakhs and converting at 1s. 2d. per rupee we get £921,000.

Again, assuming that roads cost the municipalities 60 per cent. and sanitary works 40 per cent., then 158 lakhs × 2·5 gives 395 lakhs, this at 1s. 2d. gives £2,300,000. In other words during 1893—1894 over the whole of India on sanitary works alone under one million pounds sterling were spent, while inclusive of maintenance of roads—under municipal limits—less than two and a half millions were expended. It is true that in most of the provinces the local governments both make and maintain the grand trunk roads, still it will be noticed how very small this total expenditure is for such a continent as India, especially if it were compared with the expenditure all over the British Isles for similar purposes.

It may be assumed that the large towns of Calcutta, Madras, Bombay, Allahabad, Lahore, Lucknow, Cawnpur, Nagpur, and other places, have municipal funds and are therefore able to pay for urgent sanitary measures, or are able to obtain loans when they desire an extensive scheme for water supply or drainage. In the Congress of 1891 Mr. T. H. Thornton, late Secretary to the Punjab Government, considered it prudent to concentrate sanitary efforts in towns. These he said "are the foci for radiating centres of disease. If they were set in order and made healthy much would be done: towns moreover were centres of intelligence, and their examples would gradually influence the neighbouring peasantry and render them amenable to successful sanitary treatment later on." Here, on considering the matter a very great difficulty besets one, for the population of India in towns is said to be less than 10 per cent. of the whole, so that at least 90 per cent. of mankind live in villages, and if any real good is to be done we must begin at the village. By this I do not mean hamlets of a few straggling huts, but a decent sized village of say at least 5,000 inhabitants. I therefore propose to reply to the following question:—

What are the minimum sanitary reforms which can be initiated among a conservative, apathetic and ignorant people whose means are extremely limited?

Now it is worthy of note that none of the speakers at the 1891 Congress went into the financial aspects of village sanitation, and as this is a most essential point I propose to take it into consideration first of all. The subject matter then divides itself into two heads.

I. What funds are available among Indian Sanitary Boards?

II. What minimum sanitary measures are absolutely necessary among unions?

I.—WHAT FUNDS ARE AVAILABLE?

It must be clearly understood that most of the Indian District Sanitary Boards or Unions have not the incomes the similar Rural District Councils have in England and Wales. There is neither poor rate, sewer rate, lighting rate, nor general rate. There is a road cess rate, octroi duties, and other minor sources of revenue, such as wheel tax, sale of manure, &c. An example will perhaps make the meaning clearer.

We will suppose an Indian village of 10,000 people, the local rates and taxes do not amount to one rupee per head, they may be 8 anas, are probably 4 anas, or even as low as 2 anas per head. We will suppose 8 anas a head, this for the village gives 5,000Rs., which taken at 1s. 2d. per rupee results in £292. Now take a similar sized village in England, and assume that the taxes are only 10s. a head, this gives £5,000, assume that 60 per cent. is required for the upkeep of the roads in both cases, leaving 40 per cent. available for all kinds of sanitary work, and we see that the Indian District Board has only £117 against the English Rural District Council's £2,000, or the latter has seventeen times the funds of the former.

One can do a good deal in sanitary work with £2,000, but one cannot do much with £117; for though labour is cheap enough in India, yet sanitary appliances are considerably dearer as they are generally sent from this country. The poor rate which is a big item in English rates and taxes, is not necessary in a country where the sons maintain the parents when they are passed the age of working for themselves. No wonder the Shastras bless the man whose quiver is full of sons, whereas daughters requiring dots and expensive marriage ceremonies are burdens grevious to be borne. In towns the rates, with a water supply amount to Rupees two or more per head, but even then how little this is compared to the English rates and taxes. How happy we should be if we were let off with 2s. 6d. per head for our local rates and taxes.

In the Madras Presidency there are two kinds of unions—major and minor. The major unions have the making and repairing of village streets and drains, and the constructing of tanks or wells for providing a water supply; while the minor unions have only imposed upon them the duty of cleansing streets, tanks, wells and drains. There is, however, no general act applicable all over India similar to the Public Health Act of 1875, by which the Sanitary Board can compel people to "sewer, level, pave, metal, flag, channel or make good, or so provide proper means for lighting the street within the time specified in the notice." The Honorable Lionel Ashburner, C.S.I., tells us that the Bombay Village Act of 1889, "is a well-meant attempt to improve sanitation of the rural district; but it has failed owing to the practical knowledge of the difficulties to be overcome," and it may be added, that the chief difficulty is the want of funds. Would some one suggest how these funds are to be obtained?

II.—WHAT ARE THE MINIMUM REMEDIAL MEASURES TO BE ADOPTED?

Under this head I propose to discuss (*a*) Village Water Supply; (*b*) Removal of Filth; (*c*) Necessary Action in case of Infectious Disease becoming known.

(*A*) *Village Water Supply.*

Good water is an absolute desideratum all the world over, but especially in a hot country like India, where it is likely to become easily contaminated. We shall leave river conservancy as involving altogether too large a scheme for our purpose, and consider chiefly wells and tanks which are the principal features of rural life. There is, however, one point to which it is necessary to draw attention, as the Bengal Government have lately issued a stringent resolution for enforcing sections 254 to 260 of the Municipal Act with regard to pollution of rivers at burning ghâts. *Indian Engineering* does not consider the resolution is stringent enough, for it says: "We do not underrate the pollution by human corpses, but we maintain this is small compared to the pollution caused by throwing in daily excreta, dead cats, dogs, horses, rats, animals of all sorts, and vegetable refuse from every riparian town and village."

Is it too much to ask the unions to cover up the village wells and supply iron pumps? In this way leaves and surface drainage could not enter the well and there would be no risk from contamination of infected drinking vessels. In many parts of Lower Bengal and Madras Presidency the water is only 10 or 20 feet below the surface, in which case ordinary suction pumps could be used, these might be made up locally or purchased from some of the well-known engineering firms. In this country such a pump would cost from £2 to £4 inclusive of piping, and a similar one migh be fixed up in the village for Rs. 50. In the Punjab, Rajputana, and other places well water is from 60 to 100 feet deep from the surface, in which case force pumps with gearing would be required.

I have made enquiries from Messrs. Joseph Evans and Sons, the well-known pump makers of Wolverhampton, who have kindly supplied me with the following information of costs, &c.:—

Particulars.	Fig. in Catalogue.	60-feet Well.	80-feet Well.	100-feet Well.	Remarks.
		£	£	£	
Bore of Working Barrel 2½ in. Bore of Suction and delivery pipe 1¼ in. .... Stroke 9 in.........................	303	17	19	20½	With fly-wheel for two persons to work will give 400 gallons per hour.
Do. do.	307	25½	28	30½	Do. do.
Do. do.	332	31½	28½	34	For one bullock will give 600 gallons per hour.
Suction Pump	30	Depth 20ft. only, Cost £1 5s.			Applicable to Lower Bengal and Madras.

These prices include all costs, packing and putting f.o.b., discount also will be allowed for cash payment. Messrs. Evans and Sons also inform me that two men can easily work a 2½" by 9" stroke, fig. 303, single-barrelled arrangement against a total vertical lift of 60 feet without gearing. Should the well therefore be less than 60 feet in depth, the cost of the pump would be considerably less than the £17 shown in the table. The water in the Punjab wells, distant from irrigation canals, is nearer 80 feet than 60 feet and though this may be an unfortunate matter as regards cost of pumps, yet no doubt it makes the climate drier and the people are physically stronger than those in other parts of India. As the sanitary boards cannot afford to supply all the village wells at once with pumps they might supply one or more per annum. The convenience of a fly wheel and a continuous flow of water would soon be appreciated, expecially by the women folk who have to draw the water, and no doubt the people would be willing to pay a small tax for this great blessing.

Surg.-Lieut.-Col. W. G. King, Sanitary Commissioner for Madras says, "let, however, the work be executed—let the fact be *demonstrated*, that pure water is now delivered in place of the filthy mixture formerly available, and there is no more grateful person than the villager. In short, I am of opinion that the greatest factor in preventing sanitary advance in this country is not prejudice—caste in other words—but the absence of familiarity with the methods generally dictated."

With regard to tanks it is absolutely necessary that water for drinking purposes should be stored in separate tanks from that used for washing clothes, the cattle too should on no account be permitted to go to the general drinking water tanks as is almost invariably the case, but should have other tanks allotted to them. This might be arranged by paying a small fee to the headman of the village, who could then be held responsible. On returning home from the fields cattle get into the habit of going to the same place at the tank to drink, and if they are diverted a few times they will take kindly to any other tank.

(B) *Removal of Filth.*

In small villages there is no conservancy whatsoever. In the larger villages a certain portion of ground is taken by the Sanitary Board outside the village. Some of this is screened off for the sexes and trenches dug, after a time the screens are removed elsewhere, the trenches filled and others dug at the new site. In towns Horbury's galvanised iron latrines are placed at certain depôts and kept clean by a gang of sweepers; while Moule's dry earth system is adopted in hospitals and public institutions. Surg.-Lieut.-Col. W. G. King says that in the Madras Presidency "only eleven towns are fairly well supplied with latrines, while in twenty-six others they are at the rate of one for 1,000 to 2,000 people." He also notices a retrograde movement in the cleanliness of private premises and especially privies. Here I may be permitted to give some personal reminiscenses.

During 1881-1883 I was stationed at Bhiwani as assistant engineer on the Rewari-Ferozpur State Railway. I used to visit the house of a wealthy grain merchant whose privy was on the top of his house, and the excreta used to trickle down a 4-inch recess along the face of the outer wall, the drinking water well was less than 40 feet from this wall. Fortunately the well was deep or the whole family would have been poisoned and would have attributed the poisoning to "Kismat" or fate. The interior decoration of the reception room had panels of Jaipur marble with mosaics, the walls were frescoed depicting scenes from the Epic poem Ramayan, while the ceiling was highly ornate with gaudy colors and gilding. Now Bhiwani being on the edge of the Bikanir desert the wells were chiefly brackish and sweet water was a great desideratum, it so happened that I had been ordered to make a survey of all the sweet water wells in the neighbourhood for locomotives; the merchant hearing of this came to me and offered a fee of 1,000 rupees if I would find him sweet water. I informed him that officials were not permitted to take fees but that I would give him my advice gratis. Unfortunately the ground proposed was outside his enclosure: meanwhile he had been spending large sums with diviners who lay on their stomachs all night long and pretended to hear the subterranean rumbling of waters; however, they did not manage to tap the fresh water stratum with their wands. Soon after I left Bhiwani I heard that the merchant purchased the bit of ground suggested, dug a well and to his delight came upon fresh water. What I wish prominently to bring forward is that this man did not keep his premises in a sanitary state, nor did he employ sweepers, nor did he contribute his fair share to the local rates and taxes when he could easily have done so. Yet if an epidemic arose he would be one of the first to raise his voice against the Government of India.

There is one point that sanitary boards might insist upon, and that is that private or public pails containing excreta should be covered with ashes. Every house burns wood or charcoal for cooking food so that plenty of ashes are always available. This sanitary precaution is specially necessary in India, as it is said that the average fœcal matter per individual is two or three times that produced in England. Sanitary boards might also order the burning by each householder of vegetable refuse instead of throwing it on to the street or alley. In neither case would these reforms cost money, though certain persons would have to be punished before the people learnt to do what is necessary for the public health. Lastly the unions might see that the manure from cattle is not stacked up in each courtyard to rot for ever, but placed on the leeward side beyond the village. If villagers could only be persuaded that night soil when properly mixed with loam, peat, or ashes is of inestimable value in increasing the amount of crops they would soon make voluntary efforts; Surg.-Lieut.-Col. King's advice therefore to municipalities to teach the ryot by cultivating trenched ground is an excellent one. He also noticed that in the ceded districts and in Madras men of the highest caste would go to the night soil depôts and bargain for manure just as they would bargain for other things in the ordinary bazaars.

(C) Diseases.

The common diseases in India are fever, pneumonia, small-pox, dysentery, diarrhœa, and most important of all, cholera. Everyone gets a dose of fever and sometimes pneumonia during the months of September to November when the cold weather is coming in, the remedies are flannel next the skin, quinine and nourishment. As rich and poor suffer alike I do not see that sanitary boards should be called upon to take this matter up at all, unless they can afford to build fever hospitals, and few can afford that luxury.

Surg.-Maj. Kartikar in a paper read at the 1891 Congress says, "I say then that for compulsory vaccination to be received without opposition or disgust by the vast majority of the Indian public in the present state of society, what is absolute necessary to do is to bring a calf to the very door." As this is the opinion of a native gentleman who must understand the feelings of his countrymen, large towns might adopt the novel procedure of sending calves round to each man's door. It is a notorious fact that the mortality from small-pox has enormously decreased since compulsory vaccination was ordered. Moreover, the ravages of this dreadful disease which was one of the curses of the Empire during former dynasties is considerably modified owing to the protecting ægis of the British Raj. Every person visiting India cannot help noticing that the greater number of natives one meets have had some form of small-pox, and therefore compulsory vaccination like Suttee is an irksome necessity. The deaths from diarrhœa and dysentery are due to the contamination of a filthy subsoil and impure water; when these are improved the percentage of deaths will decrease.

We now come to the worst scourge of all—cholera. Most of us who have had to do with an outbreak of cholera in our coolie camps know how difficult it is to get the coolies to burn the infected rags or to take the cholera pills unless we are standing by, and we all get severe reprimands from the Government of India for not keeping off an outbreak which we were powerless to prevent. It is said that cholera is waterborne and is of course due to Koch's cholera bacillus, at any rate in Northern India it is of frequent occurrence in the springtime when the unripe fruit comes in. If village headmen would only give warning in time the first few cases could be nipped in the bud; for cholera spreads very rapidly when it once makes a start.

Before closing it is necessary to say a few words on ventilation. At Bhiwani, which was said to contain 33,000 inhabitants in 1883, I can only remember four decently paved streets 24 ft. in width metalled with kankar. Most of the streets or alleys were 12 to 16 ft. in width and were unmetalled. Bhiwani was also a walled town, so that unless a strong wind was blowing very little air circulated at all. It will take many years teaching to induce even the intelligent Brahmin to believe that 5,000 cubic feet of air per hour constantly changed are required in an oriental climate to live healthily; as to the unsophisticated rustic, he would tell you that he much preferred 5,000 odours from his goats and herds, for do not the shastras tell him that even the presence of a cow is a blessing?

I might have said something on offensive trades, drainage and other sanitary matters, but then we should exceed the limits of village sanitation.

In conclusion, I take the liberty of suggesting to village unions as follows: After repairing the roads, devote what money you have, first of all to covering in the village wells and supplying iron pumps, and have these wells periodically cleaned say four times a year. Keep the tanks for drinking water separate from those for washing your clothes and persons, and on no account let cattle get into the former. Insist upon excreta being covered by ashes, and vegetable refuse being burnt by each householder as much as possible. By cajolery or giving honorary titles squeeze out as much money as you can from the wealthy members of the community who ought to do something to assist the British Raj which has done so much for them, enabling them to obtain such wealth as they never could have acquired under any other rulers. See that the latrines are on the leeward side of the village, and that the sweepers do the work allotted to them; don't permit offensive trades within the village itself, and lastly, when there is a cholera epidemic don't sit still and say it is Kismat or fate, but at least burn the clothing of the cholera patients. If you do even these few things you will receive the Asis or blessing, not only of posterity but also of your contemporaries, and India will certainly consider you worthy of a place in Swargâ or Paradise.

"*Notes upon the Planning of Secondary Schools,*" *by* J. OSBORNE SMITH, F.R.I.B.A.

(FELLOW.)

THE systematic supply of Secondary Schools, and the development of Endowed Schools during the past thirty years, have encouraged and indeed given great impetus to the production of school buildings of a healthier and more cheerful type than those which they supplanted.

At the request of the Council, I have prepared a few notes upon the conditions which affect the health of the children who are being taught in some of the more recently erected schools.

ASPECT.

Various opinions are held as to the most suitable aspect for class rooms, the influence of sunlight upon the young and tender being so important, no rooms for teaching should have a sunless aspect.

In south-east rooms the early morning sunlight is much appreciated during the colder months of the year, and the difference between north and south rooms from the point of cheerfulness is most marked.

In situations where it is not possible to secure direct sunlight upon the chief windows of a room, it is often possible to arrange for it to enter otherwise. The less favoured positions can be occupied by the studio, cloak-rooms, laboratory, lavatories, &c.

Class Rooms.

The dimensions and proportions of the class rooms vary, but the shape is usually found more convenient the nearer it approaches a square. When the form is oblong the main lighting should be upon one of the longer sides. The height of course varies with the size, but if the means of ventilation are ample the rooms need not be so lofty as they are sometimes made—*e.g.*, 12 feet will be found sufficient from a sanitary point of view, as well as on the score of economy, for class rooms to hold thirty to forty children.

The relative positions of the door and fireplace in relation to the windows, deserve more consideration than is usually given. Waste of space necessarily arises where both door and fireplace are not situated at the end of the room occupied by the teacher. It is not convenient for the fireplace to be in the centre of the end wall; sometimes it may be well placed near the door. The corner of the room on the right hand of the teacher is a position with many advantages.

The fireplace should contain some form of ventilating or warm air producing grate, and fresh air should be brought to it from outside well above the ground, all inlets being short and accessible for cleaning; the air chamber for warming the incoming air ought also, for cleanliness sake, to be readily accessible. In large rooms or where there are two or more external walls, it is sometimes found desirable to supplement the fire by hot water pipes under the windows or along the wall opposite to the teacher. Open fireplaces should not be omitted from schools of this kind, without very full and serious consideration of the means to be employed to warm and ventilate the buildings and especially the class rooms.

Assembly Room or Central Hall.

This important room should be near the principal entrance, and have ample means for access—it was a common defect in the earlier schools that only one entrance was arranged. This should be regarded as inadmissible except in very small schools. It is now not unusual for the class rooms to be entered direct from this room; this is done chiefly for reasons of economy, but the plan with a corridor between the hall and the class rooms has many advantages. When there is no corridor, access to the upper class rooms is arranged from a balcony in the assembly room, along one or more sides, affording excellent opportunity for the architect to display his skill in designing, a feature which unless carefully treated will be heavy in appearance and tends to diminish the lightness and cheerfulness of the room.

Side lighting for this hall is preferable for the sake of ventilation. Where top lighting is used great care and judgment are required to avoid too much glass, which, moreover, should be placed as near the sides as possible in order to prevent deep shadows being cast upon the floor from the balconies. Centre top lights are rarely successful for schoolrooms of any kind.

Good acoustic conditions ought to be secured for this room.

STUDIO.

The class-room for teaching drawing ought to be larger than the ordinary rooms to allow more space for each pupil, with easel, &c., to work in, as well as for placing groups of models, store cupboards, board racks, sink, &c. Its height should be greater than that of the other class-rooms, and the single window (if possible) should be some five or six feet at least above the floor and extend quite up to the ceiling.

LABORATORY.

The size of this must depend upon the extent to which science is taught in the school. It should be lofty, well lighted, with the window sills just above table height and extending to the ceiling; ventilation must be specially studied, particularly the means of readily producing cross currents of air at the levels of the work tables and ceiling. The floor ought to be impervious and covered with asphalt or other material unaffected by acids, &c., and to be currented to an outlet in case of accidental flooding and to facilitate cleaning. A store-room and lift, if on an upper floor, should be near at hand, also gas, and high and low pressure water.

It is convenient sometimes to plan a separate building for science teaching. The fittings vary according to the scheme of teaching, but sinks and a good supply of water are essential.

CLOAK-ROOMS.

The best position for cloak-rooms is near the pupil's entrance, plenty of light and cross ventilation are the chief requirements; stands for cloaks should be about six feet apart from centre to centre, and about one lineal foot of stand space should be allowed for each pupil.

Means for drying wet clothes are desirable, and are usually provided. Great care should be taken to separate these from the class rooms by well ventilated corridors or otherwise.

Cloak rooms of less height than 9 ft. cannot be efficiently lighted and ventilated.

LAVATORIES.

These should also be arranged near the pupils' entrance, and be separated from the main building by a staircase or lobby, with ample cross ventilation. The floors should be of impervious materials, and the height from floor to ceiling not less than 8 ft. 6 in. Each closet should have a separate window, and be entered from a well-ventilated lobby, leading out of the lavatory.

Washbasins should not be placed in cloak rooms without being screened off.

It is not necessary in any case that W.Cs. should be placed in a detached building, nor is it desirable in most schools of this class; but when they are placed below other rooms the ceiling should be of impermeable materials as well as the floors. Divisions and enclosing partitions should be solid.

OFFICE AND WAITING ROOM.

These rooms must be near the chief entrance, and if possible near the platform end of the assembly room, neither of them need be as large as a class room, but from the office windows it should be possible to see the main entrances to the building. The office is a workroom and also a reception room, it should be well lighted, cheerful and convenient with, if possible, a lavatory near at hand for the use of the head master or mistress.

TEACHERS' ROOM.

This room should overlook the playground and its entrances and be reasonably near to the office. A small cloak room, with lavatory and closet, are convenient and desirable adjuncts. It should not be less in size than an average class room. The glass line of the windows should be nearer the floor than in the class rooms, in this as in other respects the room should be regarded as a work room and sitting room combined.

LUNCHEON OR DINING ROOM, KITCHEN AND OFFICES, CARETAKER'S ROOM, &C.

These domestic rooms should be planned with a separate entrance, and be cut off from the school rooms with prompt access from the kitchen to the entrances, and from the school to the dining room. On no account should any of the noise or odours from the domestic rooms be allowed to enter the school proper.

CORRIDORS.

Main corridors should not be less than 7 ft. wide nor of less height than the rooms adjoining, windows at each end are essential, and there should be ample lighting throughout, especially at points where they deviate from a straight line.

STAIRS.

The position, form and size of the staircases are most important, no greater inconvenience in a school can be conceived than a carelessly designed staircase in the wrong place. A building designed to accommodate more than say 150 children, should have two distinct staircases as far apart as possible, and near the assembly room,

A clear width of 4 ft. is often found to be sufficient, but 4 ft. 6 in. is much better, while 5 ft. may be regarded as luxurious.

Winders and circular or elliptical staircases are inconvenient, and in my opinion ought never to be planned for these schools, wherever it is possible to avoid doing so.

The rise of each step should not exceed 6½ in.; 6 in. is better when obtainable. 11 in. should be the minimum width of the tread (from nosing to nosing). Staircases need not be lofty if sufficient head room and ample lighting be secured.

ENTRANCES.

These should be placed so as to be seen from the office or teachers' room, or to be otherwise conveniently under supervision.

PLAYGROUND.

This should be as ample as circumstances permit, and should contain fives courts, tennis courts, and if possible a cricket field, spaces for small gardens, shed for games' apparatus, &c., Trees upon the site should be judiciously preserved for their own sake as beautiful objects, and for the sake of the shade afforded in hot weather. Covered playgrounds, gymnasia, &c., should be formed in the larger schools.

WALLS.

Walls must of course be built of sufficient substance to resist heat, cold and moisture. Hollow walls in very exposed situations are useful in spite of their disadvantages, but solid walls of good materials are better for ordinary positions. All openings in walls, flues, chaces, &c., should be made accessible for cleaning.

The greatest care should be taken, and thoroughly effective means should be adopted to prevent moisture penetrating the walls from above downwards, or from the ground upwards. Solid damp-proof courses formed of asphalt, slate, cement, &c., ought alone to be used, being much more effective than the various glazed perforated substitutes.

FLOORS.

Floors of class rooms should if possible be impermeable, and covered with wood. Where wood joists must be used special care should be taken to ensure rigidity, and provide effective means of checking the passage of sound and air through the floors.

Floors of all lavatories and science-rooms should be solid, with hard non-absorbent coverings. The use of porous breeze concrete for such floors is not to be commended.

Wood floor coverings should be polished, and have skirting fillets of sufficient width to keep the desks away from the walls.

ROOFS.

Roofs, if of the usual wood rafters, and slate, tile, or lead coverings, should be close boarded, and have some non-conducting material under the outer coverings.

DOORS.

The width of doors to class rooms should be limited to dimensions which will permit the passage of the usual moveable furniture, 3 ft. to 3 ft. 3 in. is usually sufficient. Those to studios, corridors, cloak rooms, dining rooms, entrances, &c., should be wider, with pairs of doors hung folding or to swing as may be found desirable.

Glazed upper panels are very useful in assisting supervision and maintaining discipline. I have known them objected to for apparently good reasons, but they are usually found to be convenient.

WINDOWS.

The essential points to be borne in mind regarding windows are :—

1. The chief lighting for *all* rooms, except perhaps those for science teaching, should be in one wall only, that on the left hand side of the pupils, with an extra window conveniently arranged where possible for cross ventilation or extra sunlight.

2. The glass line should be as near the ceiling as possible and not nearer the floor than 3 ft. 6 in. or 4 ft. in class rooms.

3. The window frames should be as near the outer surface of the wall as appearance, Building Acts, and other circumstances will permit, to afford means for obtaining admission of air without interfering with blinds, &c., and also to allow the maximum of floor space to be used without the desks being placed too close to the glass.

4. All windows should be made so as to be opened easily by children and to the fullest extent possible, and should be constructed to permit portions of them to remain open if desired while work is going on without the possibility of downward currents of air being felt by the pupils.

To describe the various windows in use would exceed the time at my disposal, but the following are a few familiar kinds which ought to be used with discretion or not at all :—

a. Wide and heavy double hung sashes.
b. Centre hung casements.
c. Folding casements hung at side.
d. Fixed sashes.

VENTILATION AND WARMING.

The cost of forming and maintaining a system of mechanical ventilation, and the desire for an open fire for the sake of cheerfulness and prompt control account for the fact that in most of the schools of the kind under consideration the open fireplace has been utilised.

If a school building be designed to allow currents of air to sweep entirely across it during the pupil's absence; and each classroom be provided with two shafts or flues from the floor to above the roof, with inlets to each at floor and ceiling levels, in addition to a large warm air grate and suitable windows it is found in practice, that adequate means for warming and ventilation are thus economically obtained.

Their effective use depends greatly of course upon the Teachers in charge of the rooms, but it is an exception to find a head-master or head-mistress who is not keenly alive to the value of the means afforded and familiar with the use of them.

Those persons who prefer a temperature of 70 degs., and who upon feeling a slight movement of the air will block up warm air inlets, paste over the outlet openings, put sand bags at the windows and rubber tubing round the doors, keep up large fires and then complain of ill-fitting windows, and draughts are, I am convinced, rare exceptions.

Vertical inlet tubes, deep sill fillets to windows and the various valve ventilators, are all useful as aids when kept clean, but unless air is warmed before it enters a school, the inlets will remain closed during six months of the year when fires are in use. This fact accounts for the popularity of the various ventilating grates, most of which can be taken to pieces periodically for cleaning.

The assembly room, corridors, cloak rooms, lavatories, laboratory, entrance lobbies and staircases can be more conveniently warmed by hot water pipes. It should be possible to raise the temperature in the corridors, cloak rooms, laboratories, &c., to about 50° during cold weather, for the purpose of preserving a fairly equable temperature inside the building and protecting the sanitary arrangements and water services from disorganization by frost.

The small pipe medium pressure apparatus is found very useful for warming schools, on account of the small quantity of liquid used, enabling heat to be produced in less time than with larger pipes. These small pipes, moreover, can be used under skylights and in other positions where the larger pipes could not conveniently be placed.

The practice of arranging hot water pipes in channels below the floor of the spaces to be warmed, with open gratings above them, is undesirable and unnecessary in schools because of the difficulty and cost of keeping the pipes and channels free from foul matter from boots and floors.

[*For discussion on this paper see page* 548.]

"*The Sanitary Construction and Fitting of Stables, Cow Houses and Piggeries,*" *by* LOUIS HANKS.

(ASSOCIATE.)

THE subject of this paper is one of such importance that it is surprising how little it is considered, and what a small amount of reliable literature, or data, is available for reference. Among the few standard works on horse and cattle management there is hardly one which attempts to deal practically or scientifically with this important branch of the subject.

Taking the subject of Stables first, it will be found convenient to divide this into two sections: dealing first with essentials of planning, construction and sanitation; and secondly with the interior fittings, &c., adapted for different classes of horses under varying conditions.

It is obvious that the planning of stables must be largely governed by the site obtainable. What might be an ideal scheme as applied to a country house, with ample space available, would be quite impossible in a crowded district or town, and therefore general rules only can be laid down, which must be varied to suit specific conditions.

In the planning of large stable buildings it is a good arrangement to have a quadrangular yard entered by an archway under or by the coachman's residence and forage store, which will form the front elevation of the scheme. On either side of the yard can be a range of stables with stalls or loose boxes, with a sick box in one corner and a washing shed in another corner. The remaining side or end will contain the coach houses with rooms over for grooms and helpers, for whom separate W.C. and lavatory accommodation must be provided, distinct from that for the use of the coachman's family.

Part of the yard should be covered with a light iron and glass roof for washing purposes.

Another arrangement would have the buildings on three sides only of the yard, the coach house and groom's quarters on one side, the coachman's cottage, forage store, sick box, &c., on other side, and range of stables at end of yard. In the case of small stables for a few horses where (as in the case of most town sites), the animals, vehicles, and coachman's residence have to be under one roof, special precautions must be taken to secure hygienic conditions, and reference will be particularly made to this in connection with building and fitting. The site should be a dry one on natural deep gravel, chalk, rock, or firm sandy soil, avoiding all artificial or made grounds where possible, but any ordinary loam or clay, even the wettest, may be made suitable by proper foundations and careful subsoil drainage. In the case of a specially wet clay or other damp soil it is sometimes advisable to artificially raise the site within the walls from six inches upwards, by a bed of dry, clean broken brick, before concreting, forming a dry area round outside of walls to the same depth, the site to be deeply trenched and land drained.

In all cases of damp or low-lying ground the precaution of subsoil draining should be adopted, as this is a comparatively simple matter if done as soon as the site is cleared, but if it is neglected, or the evil is not discovered until the buildings are erected it is a most difficult and costly matter to rectify. It is hardly necessary to say that the ends of the agricultural drain pipes or trenches filled with furnace clinker, broken brick, chalk, or otherwise which may be used, must be carried right across the site so as to discharge into a deeper graded ditch or channel right outside the walls and under the lowest level of the foundations. These precautions if carefully followed out will effectually dry the dampest site and prepare it for building operations.

Having secured a dry situation, by natural or artificial means, the foundations for the walls of the stable building will be prepared by excavation and concreting, and when this is thoroughly consolidated the building operations will be proceeded with in the usual manner, care being taken to put in a good damp course, of lead, asphalte, slates, and cement, or vitrified tile, at least six inches above the level of the external ground. The walls should be built of hard well burnt stock bricks, faced if desired with red or other fancy bricks and set in good lime or cement mortar, or of substantial masonry, set in cement. Concrete walling has been used with advantage in some cases, but demands much care in securing homogeneity in the material, and should preferably be faced on the outside with hanging tiles or cement slabs, to ensure weather-tightness, especially in exposed situations liable to driving rains.

The internal face of all brickwork should be neatly pointed or rendered with cement and sand, steel-trowelled, but for the inner walls of a stable, cow house, or piggery, where expense is not the first object, nothing is nicer than glazed bricks or tiles. These should be of a soft tint or colour, but not pure white as the animals' eyes are injuriously affected by plain white.

White should be particularly avoided at the stall heads or sides, where a soft green, buff, or grey is very nice in appearance and restful to the horses' eyes.

A very usual and economical plan is to terminate the glazed bricks or tiles at a height of 7 ft. from the floor at the head of stalls and 4 ft. 6 in. high round rest of walls, capped with an iron moulding, and the walls above smoothly cemented and painted.

If it can possibly be avoided, no rooms or loft should be over the horses' standings, and the roof of the stable should be of open timber work neatly boarded, stained, and varnished. This has two advantages, as it gives extra height and air space, and the varnished surface is impervious, sanitary, and easily cleaned.

If circumstances compel the use of rooms over a stable, the ceiling should be in *no case* less than 10 ft. from the floor, but a minimum height of 11 or 12 ft. should be insisted on whereever possible.

It is obvious that if a height of 10 ft. is desirable in a room intended for human habitation, the greater height and bulk of a horse demands increased height and more air, so that an allowance of from 1,100 to 1,800 cubic feet should be given to each horse. This is obtained by allowing 9 ft. × 6 ft. for each stall, which with 7 ft. × 6 ft. of passage-way at heel gives 96 ft. superficial of floor space, which multiplied by 12 ft. nett height gives 1,152 cubic feet.

For loose boxes a floor space of 12 ft. × 12 ft. should be allowed where possible, and never less than 10 ft. × 10 ft., with passage space extra.

The construction of the ceiling in question should receive much more care than is usually bestowed.

The best form would be a light iron and concrete floor for the loft or rooms over a stable, as this has several advantages. It is fireproof, sound-proof, durable, and impervious to the passage of any vitiated air from the stable below. The underside forming the ceiling of the stable can be smoothly cemented and painted or whitewashed.

If a wood joist and a boarded ceiling is the only one available, several precautions must be taken.

The floor boards should be grooved and tongued, the joints stopped, and the floor of the upper rooms varnished, the under surface of the joists being carefully lathed, plastered, and painted, to form an impervious stable ceiling. A better plan in many respects, but not quite so neat, would be to form a ceiling of flat iron sheets, butted closely together and nailed to the underside of the joists. This could be painted, and would form a more permanent and sanitary surface than the lath and plaster.

If the rooms over must be used for dwellings, under no circumstances whatever must the staircase or any shaft or ladderway communicate directly with the stable, or all the vitiated air and heat will ascend thereby into the rooms above. Serious illness has been repeatedly caused in this way, and always risk and discomfort to the occupants.

An external staircase, or one divided by a brick partition from the stable, should always be provided; and if such an internal stairway is being formed, it is a good plan to make the space large enough to accommodate the hay and corn shoots as well, as fodder is absorbent of foul odours, and should not be in communication with the stable directly, as in the case of a loft over.

The stable roof can be of tiles or slates, &c., and does not call for special mention, except that provision must be made for one or more exit ventilators for foul and heated air. If one large exhaust ventilator is to be employed, as in the case of a stable with rooms over, it must be connected with the stable ceiling by means of an air-tight metal shaft, passing down hermetically sealed through the upper rooms, and carried along the stable ceiling as a horizontal duct, having ventilating gratings in the bottom at intervals of about six feet for the entry of foul heated air, which will travel along and be drawn up the outlet shaft by the exhaust ventilator on roof.

If there are no rooms over the stable, one or more ridge or turret ventilators must be provided, with folding or sliding louvres, which can be opened or partly closed by cords or gearing as the temperature may require.

Fresh air must be admitted in such a way that each animal gets an ample allowance without draught, as draughts do as much harm as the fresh air does good. This is best obtained by fixing an adjustable louvre or hopper ventilator in the wall at the head of each animal's stall or box, about two feet above the top of the stall partition.

The advantage of the hopper type is that the current of air does not blow directly on the animal, but is deflected upwards for a short distance, and then falls by gravitation towards the floor displacing the lighter heated air, and then in its turn, becoming hot and foul, consequently lighter, and rising by levitation to the outlet ventilators in roof or ceiling, as before described.

The Sherringham Inlet Ventilator is one of the oldest and best, being easily procured, cheap and readily fixed, and it will admit a sufficient supply of air for one horse or cow. The Crosse ventilator is slightly different in form, but very useful in all respects. Some of the adjustable glazed hopper ventilators made by professional stable fitters are also very good and sanitary.

The use of a thermometer should always be insisted on in a stable or cow-house, so that an equable temperature may be maintained, cool in summer and moderately warm in winter. Overheating is a thing to be avoided, otherwise the animals are apt to be chilled on going out. As long as they are shielded from damp, from the inclemency of the weather, and from draughts, the heat of their bodies and bedding will keep them comfortable and healthy. This question of ventilation is one of the first importance, and should receive more careful consideration than it usually does.

It is often difficult in town stables to get the ventilation at heads of stalls direct from the open-air, on account of adjoining buildings, and in such cases it is advisable to fix a horizontal metal shaft along the wall of stable over the heads of horses, with one end freely open to the external air, and the other end continued up from far end of stable as a vertical shaft to above the roof.

A current of air will always travel along this, and the inlet ventilator at head of each stall is simply fixed in this air shaft, from which air will blow in freely. The top sash in every stable window also should have one pane made to hinge or swing on centres, so as to be available for ventilation. In all cases the thermometer should be watched.

The next important point to consider is the floor, which must be hard, durable, impervious to moisture, but not slippery.

Under all circumstances, whether in town or country stables, it is imperative that the *entire floor* be concreted to a depth of six inches with good cement concrete, in proportion of one of cement to six of gravel or burnt ballast, laid to proper falls for facilitating the flow of surface drainage and to keep back the ground damp. On this various kinds of paving can be laid. For a first-class stable one of the best pavings is the Chamfered Adamanatine Clinker brick, bedded in cement and well grouted with fluid neat cement. It is well coloured, hard, gritty, and durable.

The blue Staffordshire paving brick is also a good paving and largely used; but with any brick paving special care must be taken in grouting the joints thoroughly with impervious cement, otherwise the least crevice will permit drainage to soak in and smell.

For this reason large number of stables are now laid with patent cement floors, which are formed of a three inch thickness of Portland cement mixed with pulverized granite, &c., laid in situ, on a four inch bed of dry broken brick, laid to falls and with the finished top surface scored or grooved to give foothold for the animals. When properly laid and well grooved this is doubtless the best and most sanitary paving as it is homogeneous, and the absence of joints offers no entry for liquids, thus possessing an undoubted advantage over any of the jointed brick pavings. Great care must be taken in securing the best material, well laid and of sufficient thickness. It is obvious that different classes of animals require different strengths of paving. Even a two inch thickness of granite cement paving will stand light carriage horses, but the writer has seen this thickness stamped right through by heavy dray horses, for which a three inch thickness is none too much.

The all important question of drainage is now to be considered. It may be at once stated as a cardinal rule, that *no* underground drains should be permitted in a sanitary stable or cow shed.

The best plan is to have the paving itself sloped with an even fall of four-tenths of an inch to the foot run, from sides to centre of stalls and boxes and from head to heel, also the same slope from upper to lower end of stable.

This will form a valley or depression down the centre of each standing, from head to heel, along which liquid will freely travel, to be collected by a similar shallow gutter along the heels of stalls or range of boxes, falling to the lowest point where the surface gutter will pass as a half channel pipe through the outer wall of stable, discharging over a trapped gully in the open air.

This gully should be a large and deep one, fitted with a removable iron pan or bucket to catch any dung, straw or solid matter which can be removed every day. By this means all underground drains are avoided within the building, but the objection has been occasionally raised that the shallow surface channels allow the animals' bedding to become soddened with wet, causing nuisance and discomfort. In the writer's opinion this is a very feeble objection, but to obviate this special iron sunk gutter channels with movable perforated iron covers can be fixed half way up each stall and along heels of same, jointed with proper tee and angle piece connections.

The liquids then run through the holes in the covers into the sunk gutter, which can, if desired, be made with sloping bottoms of the same four-tenths of an inch to one foot gradient already referred to.

By this means the paving can be kept nearly level, the graded gutters carrying all liquids rapidly away. All that is necessary is for the covers to be lifted off and channels swept daily.

To make this system still more perfect the draw off tap for water can be fixed at highest end of stable over shallowest part of gutter, so that the waste water can flush the gutter and the tap be turned on for this purpose.

This system will keep the stable sweet and the bedding dry, and is well worth the extra expense of construction.

Care must always be taken not to exceed a slope of four-tenths to half-an-inch per foot run in any direction for stable paving as anything steeper than this imposes an injurious strain on the ligaments of the horses' legs while standing in a stall for any length of time.

Serious trouble has been known to result from too steep a pitch. The slope of four-tenths of an inch to one foot may be relied on as the result of years of practical experience in stable paving.

The fitments of the stable have lastly to be considered. These should never be wholly of wood, as this is clumsy in appearance, easily damaged, liable to infection, insanitary, and difficult to keep clean.

The heel posts or columns of stalls and loose boxes should be of stout cast iron from four inches to six inches diameter, and not less than five-eighths to three-quarters of an inch in thickness, otherwise they will be fractured by a kick. They should have projecting flanged bases twelve inches square, with holes for belting to a good stone base twelve inches below the ground line, or with eighteen inch long bases with a double flange for embedding in a mass of concrete. If such base fixings are carefully made they will stand the hardest wear for years without movement. The posts should be capped with a round ball head and rounded mouldings. No sharp corners, mouldings or projections can be tolerated for a moment in any stable fitting, as serious accidents have resulted from such vagaries on the part of inexpert founders and ironmongers, ignorant of stable requirements.

For the same reason no spiked or projecting post heads, brackets, or ring staples should be used. Every hard surface in a stable must be smooth and rounded off, even at the sacrifice of appearance.

Wrought iron posts are sometimes advocated on the score of less liability to fracture, but wrought iron is more easily corroded in a stable, the shafts of stable posts are simply made of thin wrought iron gas pipe with bases and caps cast on, and altogether practical experience favours the use of stout cast iron in preference to wrought iron for posts.

The divisions between stalls usually consist of an iron sill at the ground line, a panel of hard, varnished grooved and tongued boarding, about 4 ft. 6 in. high from post to wall, surmounted by a top panel of wrought iron vertical-barred grating, with a strong grooved mid-rail to receive top of boarding, and a rounded top capping, which is ramped from 7 ft. high at head of stall to about 5 ft. high at post end. This top of grating is 7 ft. uniform height all round loose boxes, having a wood panel 4 ft. 6 in. high at sides of box, but the front grating being rather more open, say three feet of woodwork and four feet of open ventilating grating. The sides of loose boxes should always be less open than the front, or the animals will be fidgetted by seeing each other. For this reason a solid panel about three feet long is often inserted at the manger end to prevent the horses seeing each other whilst feeding.

The doors of loose boxes should be strongly framed of iron or wood, with a top panel of ventilating grating, and a safety latch which the horse cannot open himself, and which offers no projection open or shut against which he can hurt himself.

The mangers should be fixed about 3 ft. 6 in. from floor, or slightly lower according to height of horse. For private stables where loose hay is used the manger fitment should also contain the hay-rack, so that the horse can feed underhead. It is well also to have a water-pot alongside, which is always handy for giving a mash, even if the horse is usually watered from a bucket. The customary stall fitment consists of an iron top plate the full width of the stall and supported on a bracket each end, having three large openings with rounded lips. To the opening at one end is bolted the hay-rack, which should have a seed-tray at bottom to prevent waste by dropping. The centre opening receives the manger, which should be wide and deep to prevent the corn being tossed out by the horse in feeding. In some cases it is necessary to put an iron cross-bar at each end to prevent the horse indulging in the trick, leaving space between for him to reach the corn but no more. The water or mash-pot is fixed at the other end of the fitting, and should have a waste-plug at bottom for quickly letting off stale water into a bucket or down the surface gutter.

Both manger and trough should be of galvanized or enamelled iron. The hay-rack and top plate being galvanized or japanned. Care must be taken that the edges of all openings are rounded and curled under or a horse will cut or chafe himself.

The front edge of the manger plate must be carefully curved under or formed into a barrel for the same reason. In many cases it is a safe and neat expedient to board in the front of the manger fitting, sloping from under the curved lip right back to the wall just above floor. This prevents crib-biting, prevents a horse getting his bedding pushed under the manger and prevents danger to the animal in rising from the ground. The loose-box manger fitment is usually constructed on the same principles but adapted to fit a corner of the box, although in some cases, especially in racing stables, the manger and hay-rack are in separate corners.

Overhead hay-racks should be avoided as the horse in pulling down his food gets dust and seeds in his eyes.

In the case of the hard-working horses of omnibus, tramway, and carrying companies, contractors, fire brigades, business firms, &c., it is so generally and successfully the custom to give them chopped hay and bruised corn mixture, that in most cases no hay-rack is used, there being one long open manger, or a manger and gruel pot in each stall. The pan should be deep and wide with cross bars at each end to prevent food being thrown out. In some cases the pans are made to lift out for cleansing, but anyhow, both plate and pan must be of painted or galvanized iron.

Much could be said on the subject of halter tyeings, harness fittings, cleaning hooks, &c., but space forbids. Corn bins should be of iron with divisions, hinged lids and locks. Stable buckets should be of iron, with wood bottom rims, so as to be clean without being too noisy.

With regard to cow fittings, the general rules laid down for the sanitary construction, ventilation and drainage of stables will all apply to cow sheds, but a few additional matters have to be considered. It is advantageous in planning a cow house to arrange the standings so that there is a feeding passage between the heads of the stalls and the back wall, so that the animals can be fed without the necessity for the attendant to push by them to reach the troughs. There will of course be a wide passage at heel of stalls, and in many cases the floor of stalls is raised a few inches above the level of passage.

The divisions should be entirely of iron, situated eight feet apart for a double stall to hold two cows, or five feet apart for one cow. The divisions usually extend only about half the length of the animal, as this is sufficient. The regulations made under the Dairies, Cowsheds and Milkshops Order of Local Government Board, 1886-86, give a minimum stall space of 8ft. × 4ft. for one cow, or 8ft. × 7ft. for two cows. A slide and ring is fixed in the middle of each division for attachment of the binding chain. The food trough must be of iron fixed near the floor, or of strong glazed earthenware. If for a double stall it should have a partition dividing it into a compartment for each cow. The stall division is cut away so that the water trough is fixed midway under it sufficient for two cows, but with the division shielding one cow from the horns of the next. The hay-rack is fixed just above the manger and is usually continuous the whole length of the shed.

Nothing but iron should be allowed for the fittings, as it can be cleaned and disinfected. Wood cannot as it is pervious, absorbent, and a fruitful source of contagion. A separate apartment should be provided for a calving pen, and another one with a copper, hot water supply and impervious underground pit for grains; also bins for meal, bran, &c., quite separated from cow shed. An ample supply of water should be provided in a covered cistern fixed at least six feet above ground with open overflow, providing at least twelve gallons for each cow, the water being laid on to each cow trough, which will also have a waste plug. No w.c., urinal, or dwelling room to communicate with cow shed.

All the rules for sanitation, cleanliness, &c., as laid down for stables are even more important as regards cow sheds, on account of the important bearing on food supply.

Piggeries should be constructed with as much care and sanitary forethought as either stables or cow houses. There is no reason why the pig should exist in the usual filthy state. The styes and yard enclosures should be of iron or of brickwork cemented. The styes should have a passage at back for cleaning purposes, with doors of communication.

The yards should have the feeding troughs in the front outer wall by side of the gate, as they are much better in that position than as sometimes placed in the back wall of stye,as the animals in the latter case slop their food over their bedding in eagerness to reach the troughs. This matters less in the open yards. The troughs should be entirely of iron, with a hinged falling shutter, which can be pushed inwards and bolted, while filling or cleaning the troughs, and secured outwards at other times. The paving should be as described for stables and cow houses, with surface drainage only.

In the case of cow sheds, piggeries, and country stables, it is economical to convey the surface drainage to an impervious covered catch pit in open yard, and pump it from there as required for use as liquid manure.

In town stables, &c., even with surface drainage, a proper modern system of sanitation must be adopted, thoroughly ventilated and disconnected from sewer. The receiving gully trap outside stable wall will communicate by a watertight pipe drain, with a proper covered manhole in the yard or mews, not connected to the general house drainage, but running direct to an intercepting manhole nearest to sewer from which it is disconnected by a siphon trap, with fresh air inlet ventilator and up-cast vent pipe as for house drainage.

[*For discussion on this paper see page* 548.]

"*Sanitary Fittings and their Connections*," *by* W. E. Bland, R.P.C., Lecturer on Sanitary Science, Durham College of Science, Newcastle.

When honoured with an invitation to prepare a paper for this Congress, it occurred to me that one on "Sanitary Fittings," might lead to a discussion on many points connected with the subject, upon which opinions widely differ. There exists, unfortunately, a general indifference, and consequent ignorance, on the part of both owners and occupants, of the various sanitary fittings with which the average house is surrounded, an indifference, it is to be regretted, which often extends to those responsible for the work, and many cases of disease and suffering are traceable to their neglect.

I find that certain fittings, advocated, and even demanded, by the authorities of some towns, are condemned by others, though the circumstances attending their use are equal. This should not be the case, although differences of opinion will always exist.

It is impossible to deal with such a subject fully within the twenty minutes allowed for each paper. I have therefore decided to confine myself to those fittings met with and used in an average middle class residence.

Monetary considerations are responsible for many of the evils which exist, but whilst freely admitting that cost demands thought in all such matters, I venture to think, that most of those now present will agree with me in the opinion, that many of the so-called cheap and useless fittings, now being used, should be prohibited as dangerous to health and life.

The sewer intercepting trap demands first consideration, it being now looked upon as a necessity; undoubtedly the ventilation of the public sewer, by the town authorities, is rendered more difficult by its use, but the fact of the proof that typhoid and other fever germs, discharged into a sewer, can, not only live there, but multiply and be carried in the sewage wherever it goes, leads me to think that the practice of disconnecting the house drain from the common sewer is a wise one. We should guard our homes against danger from below ground, as carefully as we do from above.

Respecting the ventilation of public sewers, I would suggest that suitable extracting shafts might be carried up the towers and steeples of churches, chapels and halls, &c., without seriously affecting their appearance; and with good effect, as such buildings are generally placed pretty central in thickly populated districts.

There is a great variety of disconnecting traps manufactured, sections of some of which I illustrate.

They are frequently placed at some considerable distance from the house, making it difficult for them to be properly cleared by small discharges, (such as from lavatories, and the two gallon flush of a water closet, which lose their force en route) if not so constructed as to form the least possible resistance. At the same time it is requisite that a water seal of not less than 2½ inches be provided to resist the back pressure of the gas in the sewer. In my opinion, a V-shaped trap meets, most suitably, these requirements, as it contains the least quantity of water, and consequent resistance, to obtain the necessary water seal. By carefully constructing the inlet to the trap the energy of the flush can also, to a certain extent, be concentrated at this point to act with greater force; this can best be done by slightly contracting the channel or pipe connected to the trap, giving it a quick fall, and allowing a vertical drop of some three to four inches upon the standing water of the trap.

By the extra fall the velocity is increased, by contracting the channel a deeper volume is obtained, and by the vertical drop pressure is gained, and these advantages act just at the point they are most required. I give an illustration showing the section of such a trap, and also one having its inlet and outlet on the same level.

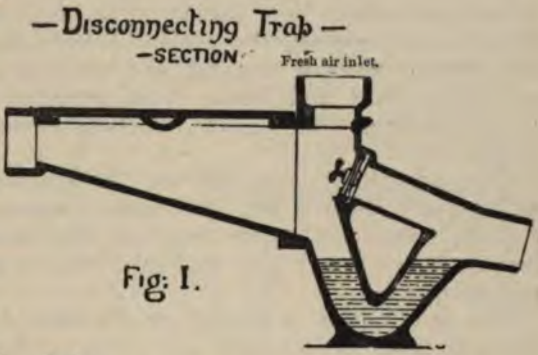

Fig: I.

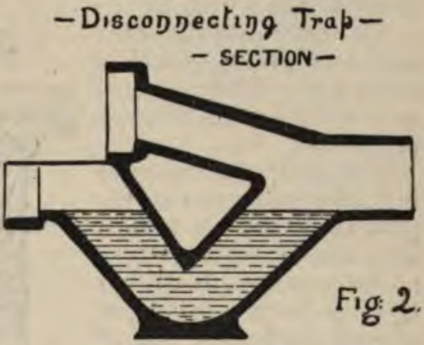

Fig 2.

This latter was doubtless constructed, to disconnect an old drain already laid, and save the expense of altering the level of the pipes which would be necessary to allow the trap, before described, being used. When reduced in the neck and body it answers fairly well and is much better than having no disconnection, though soiled paper and other matter will float on the surface of the standing water; these accumulate, and are liable to choke the trap if not dislodged by the bath flush or other forcible discharge.

The cost of these traps would be about equal; and yet hundreds of the latter are used on new work, where ample fall could be obtained to allow of the better designed trap being used. This, I contend, is one strong instance of the indifference to which I have referred.

Another objectionable point in connection with this fitting is, that the trap and channel are usually left open at the bottom of a chamber provided with an air-tight cover, thus allowing the chamber to become a foul air shaft.

I think the trap and channel should be constructed to receive the air-tight cover, similar to those for iron drains, the chamber would then be for means of inspection only, and the necessity of making the cover of the chamber air tight would be overcome, a difficulty seldom effectually carried out in practice.

The stopper or cap, giving access to the drain beyond the trap, should also have a much safer means of jointing than is usually provided, or the object for which the trap is fixed will be defeated* (say a clipped brass screw cap). The simplicity with which cast iron sanitary fittings can be secured is a strong recommendation in their favour. I should, however, view with the greatest concern, the general introduction of iron drains and fittings without a rigid, and most carefully drawn out set of bye-laws first being issued, stipulating the strength, weight, coating, jointing, &c., necessary to secure a permanent result.

Otherwise, light iron pipes and fittings, roughly cast inside, without any effective protection against corrosion, and cracked sockets, would find their way into the speculative building, leaving a state much more deplorable than exists at present, on such property.

The next fitting requiring consideration is the gully-trap, generally fixed to disconnect sink, bath and lavatory waste-pipe from the house drains.

The illustration shows the section of a fitting, which is still being extensively fitted on works at present in course of erection.

This gully, by its water seal, effectually prevents the passage of bad air from a dirty drain (or sewer, where no sewer trap is fixed). It however has the failing, of not only collecting, but of retaining all manner of refuse matter, which, if not regularly cleared away, decomposes, and throws off gases, quite as objectionable

— Gully Trap —

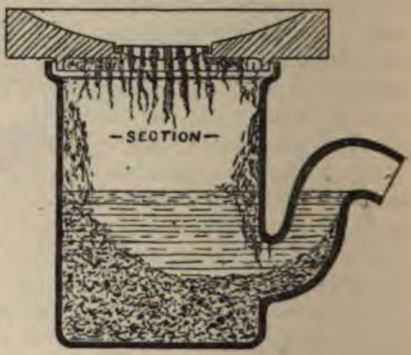

Fig: 3.

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* The back pressure in a tidal sewer is sometimes quite sufficient to blow out the ordinary bedded or slipped stopper.

and dangerous as those it is provided to obviate. As a matter of fact, those kind of gully fittings, become, in course of time, so many small cesspools about a house, for they are seldom cleaned out, and when this is done properly, the cleaner runs the risk of inhaling the drain air by breaking the water-seal. The old pan closet, which has been completely banished, was little worse than this fitting.

I am aware it has been remarked, that it is necessary to collect this sediment which might otherwise choke the drain; this argument only holds good in very large establishments and hotels, where a large quantity of grease is sent in to the drains. In the average villa or terrace residence, where the drains and fittings are properly arranged, it has been repeatedly proved, that such sediment is effectually carried into the sewer; where it should go, as quickly and completely as possible.

—Improved—
—Gully Trap.—

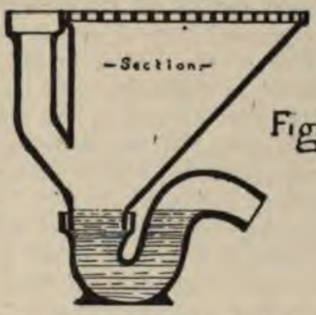


Fig 4

A properly formed waste disconnecting fitting should be of rounded form, having a water-seal of not less than 2¾ in., and a large hopper top and grate, to admit of air and light penetrating to the standing water; sunlight being unfavourable to the life of most fever germs, and a disinfectant.

It should receive the discharges below the grating, so that they may act as a cleansing force upon the trap and drain; this is especially the case from a bath discharge, and I would strongly press this point as one worthy of more consideration on the part of architects and drainage contractors.

The grease-trap hardly comes within our consideration—seldom being required in an average sized residence; there are however, so many badly formed fittings used for this purpose, a brief consideration of its duties might be profitable.

Its object is to intercept greasy matter, when discharged in quantities so large as to be liable to congeal, before being carried to the sewer, and thus choke up the drains. Grease becomes solid on cooling, and can best be collected by taking advantage of this property. The grease trap should therefore have a sufficient capacity to keep the temperature of its contents low, the discharges should enter below the water level, and be made to pass through as slowly as possible, to enable the grease to congeal and separate itself from the water.

It should be ventilated and placed in an easily accessible position, as it requires frequent and regular cleansing. It should be so trapped from the drain, that it can be thoroughly cleaned out in all its parts without breaking the water seal. The general form of grease trap receives the discharges on the surface of the water, breaking up the grease, and making it difficult to clean out, with loss of water seal in doing so.

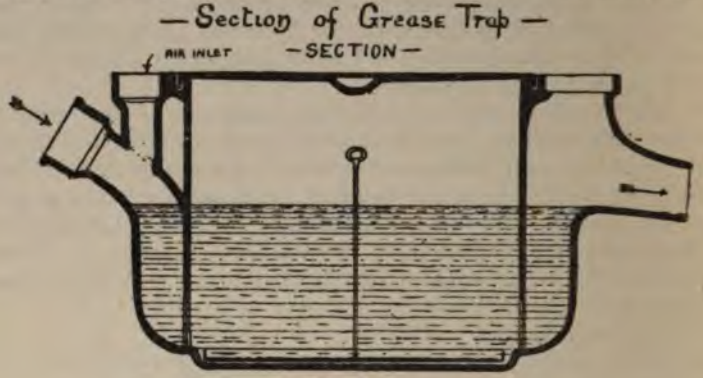


Fig 5.

Irregular attention, the unpleasant operation of cleaning out such traps, and the difficulty of disposing of the grease as it accumulates, has led to the adoption of an Automatic Flushing Tank, of sufficient capacity to break up the solid grease, and carry it in that form direct into the sewer.

There are several other external fittings I should like to deal with, but want of time renders it necessary to pass on to internal sanitary fittings.

Water-closets naturally call for first attention, as there is no other fitting with respect to which such a difference of opinion exists.

In some towns I could name, the wash-down style of closet is objected to, and the wash-out demanded; whilst in others further north—Glasgow, for instance—the wash-down is insisted upon, and the wash-out condemned, and yet the water company's regulations, in each case, stipulate a two-gallon flush.

We all know that large numbers of these fittings have only the recommendation of cheapness, and their use practically means laying on sewer gas to a house, instead of protecting its occupants from such a danger; the fact, however, that they are still daily being fixed shows that indifference still largely prevails on this important matter.

The best way to face the difficulty of deciding which are the most sanitary is to find out what are the chief requisites of a really efficient water-closet. Briefly, they are as follows:

1st. Simplicity of action in its working parts.

2nd. A perfect and efficient water seal of not less than 2½″.

3rd. That no dry surface shall be exposed to contamination.

4th. That the basin shall retain a sufficient area and depth of water to immediately drown the deposits, and prevent smell whilst in use.

5th. To have a flushing arrangement that will enable the contents of the basin and trap to be completely changed by the regulation flush.

6th. To have a secure and permanent means of connection to the soil pipe or drain, that can be easily examined, or repaired when desired.

I am no advocate of ornamentation on water-closets; providing, however, its usefulness is not interfered with, it may be added to any extent, and a pet name given to it also if so desired.

The fittings at present in general use are known as—

The Valve Closet.
,, Hopper Closet.
,, Wash-out Closet.
,, Wash-down Closet.
,, Siphonic Closet.

The Valve Closet was about the first introduced, and with its improvements up to date is still, when properly constructed, one of the best fittings in the market, having all the above requirements, with the exception of the first—simplicity of its working parts.

—Valve Closet—
— SECTION —

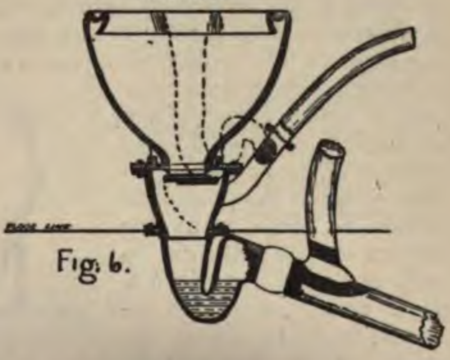


Fig. 6.

It should be constructed on the "Pedestal" principle, so that the wood casing and objectionable safe can be dispensed with, should have a flushing rim (not pan), and its overflow ventilated and out of reach of contamination.

When discharged it allows a large body of water to go down with the excretal matter, which prevents, to a great extent, the furring and staining of the soil pipe and drain (an important item). It is, however, too costly for general use, and, indeed, unsuitable also, requiring more consideration in its use than it would be likely to receive.

The hopper-closet is well known, and when properly shaped will, with attention, do its work fairly well with an ordinary flush.

The hopper should be short and fixed on a pedestal base (without casing), preferably of lead, which allows of a soldered joint being made on the outlet-side of the trap, or a brass thimble to caulk into the drain.

Its weak point, however, is that it retains insufficient water, and exposes a large area of dry surface to contamination, which no ordinary flush can possibly keep clean without the assistance and free use of the closet brush, which it too seldon gets. When lead traps are used they should be freely ventilated to prevent their destruction from within, and protected from lime and cement against a similar action from outside.

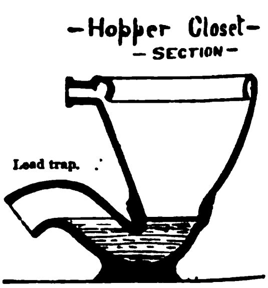


Fig: 7

The wash-out kind was next constructed to obviate the exposure of so large a dry surface associated with the hopper style, by the introduction of a dished out basin containing a body of water. It is not possible, however, to obtain a depth of more than three-quarters of an inch in the dished portion (quite inadequate), without introducing a resistance too great for any ordinary flush to effectually remove together with the contents of the trap. The traps are so shallow in some of these closets that not more than three-quarters of an inch water seal is obtained. I need hardly say it is not safe to use such a fitting. The out-go is so placed that a large portion of the flush is washed against the side of the basin. When this closet is adopted care should be taken to fix the cistern at such a height as will not give the flush a force strong enough to rebound from the side of the basin, or an eddy will be formed in the dished part that will prevent it being cleared

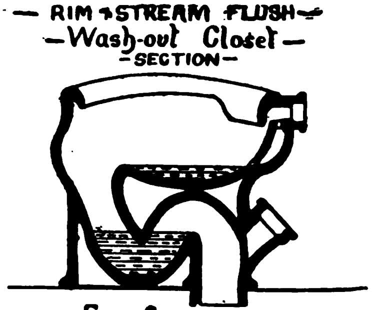


Fig: 8.

of its contents. This can best be overcome by a combined stream and rim flush.

Generally speaking this kind of closet meets few of the requirements of an efficient appliance, and I do not feel justified in having it fixed especially with a two-gallon flush.

The wash-down closet was introduced as an improvement on the wash-out, and I think a decided advance in the right direction; when properly constructed a large area and depth of water can be retained in the basin, providing an efficient seal to the trap. The outgo being from the bottom, the full force of the flush acts immediately to clean the basin and trap together.

The connection should be made above the floor-line. An after flush is also necessary to insure the full seal of the trap being retained, and care should be taken to see that this after flush chamber is so placed as to entirely empty itself, or it is liable to fracture by frost in winter.

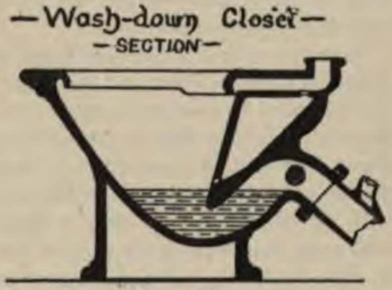


Fig: 9.

The siphonic action has been recently applied to water-closets with very good results. A depth and area of water can be retained quite equal to the valve closet, without any mechanical working parts to get out of order; an extra deep seal of from 3½in. to 6in. can also be obtained. They can be effectually flushed by an ordinary syphon cistern, and are quick and quiet in action.

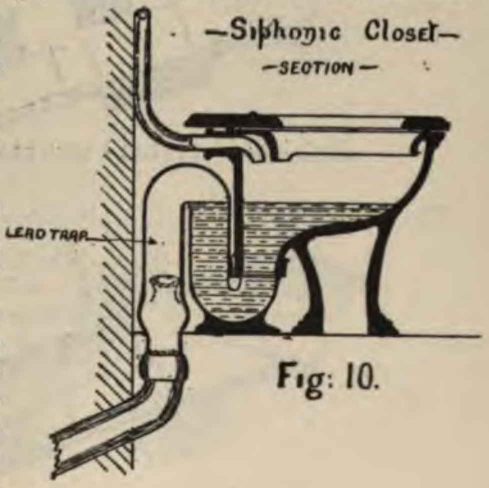


Fig: 10.

Its connection can be securely made by means of a soldered joint.

In every way this style of closet meets with the requisites mentioned as being essential in a perfect closet-fitting, and will no doubt, when better known, come into general use.

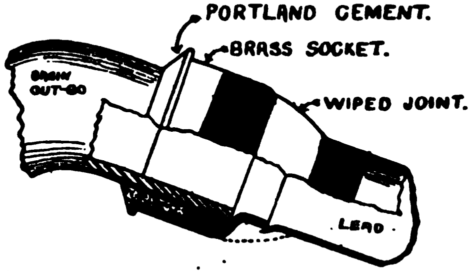
A closet that is silent in action is much to be desired. It is most annoying to have your sleep disturbed by a rushing of waters and creaking of levers and valves; it is equally unpleasant to have your visits to such places advertised in a similar manner.

There are several methods of connecting the basin and the soil-pipe, a most important item, and yet one upon which the greatest indifference and carelessness prevails. I dare venture the assertion that over seventy-five per cent. of the closets fitted in this district during the last six months have been connected to the soil-pipe or drain by a slipped putty or red lead joint, which cannot be looked upon except as a doubtful and improper connection.

Surely authorities who have power to condemn a defective joint in a drain outside the house and below the ground, should have power to condemn such an imperfect connection inside the house. If they have not such power it is time they had, and that it should be immediately exercised in stopping at once and for good so dangerous a practice, in all new buildings at least.

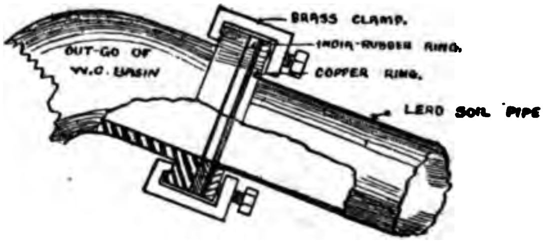
I illustrate many efforts that have been made at various times to ensure a perfect joint to the soil-pipe, as follows:—

The brass socket and cement caulked joint.



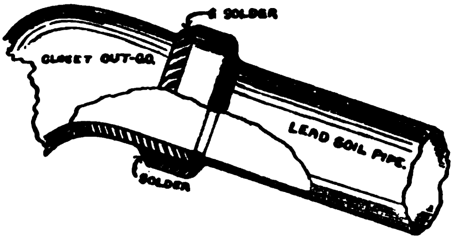
BRASS SOCKET + CEMENT CAULKED JOINT.

The brass ring and bolted rubber ring joint.



—CLAMP + RUBBER RING JOINT—

The threaded basin and brass collar joint.
The soldered lead joint (most secure).
The porcelain and lead soldered joint.



PORCELAIN & LEAD SOLDERED JOINT.

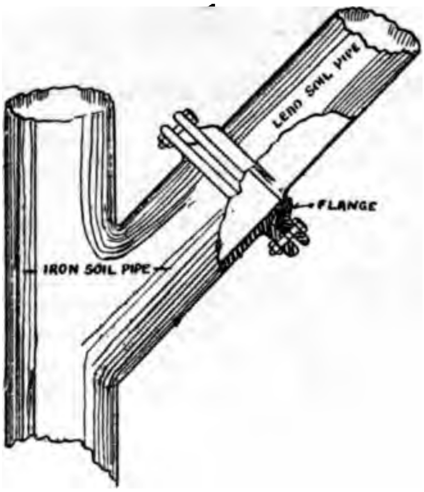
The latter is gaining daily favour and is a clever arrangement.

By coating and burning a metallic substance upon porcelain it practically becomes alloyed to it in such a manner that will enable a soldered joint to be made effectually. A fairly secure soldered joint can also be effected without the coating.

Care is equally necessary in connecting the lead and iron pipes, which is also generally made by the "unreliable-slipped putty-joint."

The more secure methods of making this connection are as follows:—

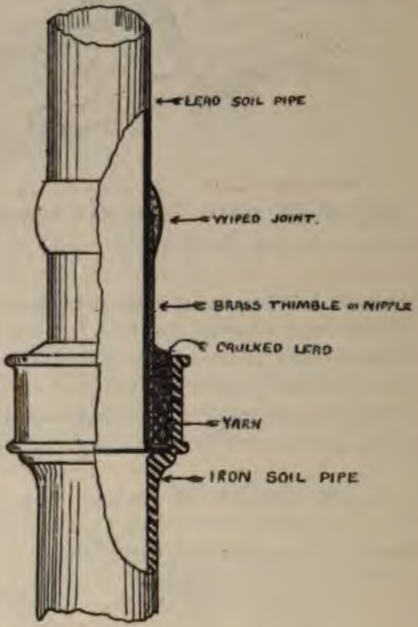
1. By a tapered flange and bolted joint.



TAPERED FLANGED & BOLTED JOINT.

2. A grooved and turned flange and gland joint.

3. By soldering a brass or copper nipple to the lead and caulking it securely into the iron socket, the latter arrangement is looked upon as most secure, as a galvanic action is liable to be set up where lead comes in direct contact with iron.



—BRASS THIMBLE CONNECTION—

Similar care should be exercised in jointing the soil-pipe to the drain at the foot. A deflecting foot-shoe should always be provided if the discharge has a direct vertical drop.

The question of the flushing of closets will be brought before you by others during the Congress; I will therefore pass over this part of the subject with the brief remarks that, whilst two gallons can be made to clear a closet fitting, it is obviously absurd to expect it to keep the soil pipe from a third or fourth story closet clean; and whilst this limited supply is enforced, I contend it is impossible to obtain that perfection in sanitary arrangements so much desired.

Baths, lavatories, and sinks in their turn require the same careful consideration in construction.

It is important that the outlets should be somewhat larger than the trap and waste pipe, so that a sufficient influx may be obtained to entirely fill and clear them, and pass quickly into the drain with the same object.

Little fear need be entertained about the cleanliness of drains having a properly arranged bath discharge into them at the head of their system.

It is a very common fault to fix unnecessarily large traps below these fittings. It should be obvious to all, who will give the matter fair consideration, that a trap which is larger than the inlet grate feeding it cannot be properly flushed; it accordingly fouls and becomes as objectionable as the dirty waste pipe, the smell from which it is intended to prevent.

Waste and overflow fittings present the greatest difficulty. They are generally cast on and form a part of the appliance, being in dark, concealed places, and quite inaccessible for cleansing purposes.

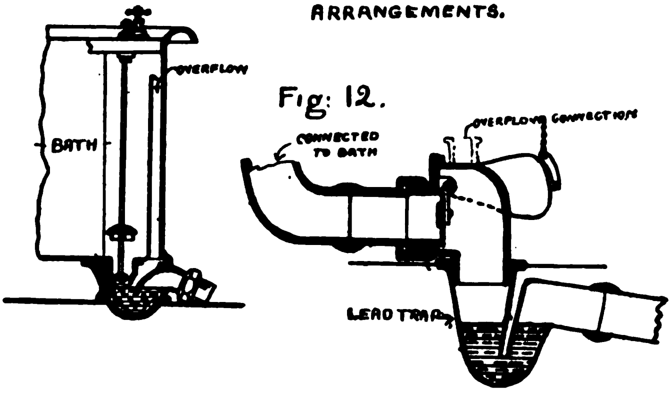
Such arrangements cannot be considered as satisfactory from a sanitary point of view. I have already spoken of the influence of light, especially sunlight, as a powerful disinfectant, and destroyer of bacteria.

The great object to be arrived at, therefore, is to have all the fittings exposed as far as possible to the light. The overflow pipes should not be cast on, but separately fixed to the fitting, in such a manner that they can be easily disconnected and cleansed. The trap should be fixed immediately under and close to the outlet, so that the least possible surface is exposed to contamination.

The illustration shows a very neat arrangement applied to the baths of a Glasgow firm. I should like, however, to have seen the overflow unattached, say in the form of a strong

SECTIONS SHOWING QUICK BATH WASTE ARRANGEMENTS.

Fig: 12.



glass tube, with a ground-in joint at the bottom, so that it could be lifted out and put under the tap when fouled. I do not see any difficulty in its application to either a bath or lavatory.

The practice of fixing baths along the side of the wall is neither necessary nor proper. They should be fixed in such a manner that free access can be had all round them. I have frequently traced an objectionable smell to an accumulation of soapy splashings between the wall and the bath.

Of all sanitary fittings inside a house the scullery sink demands special attention, being frequently situated where food is prepared and stored.

It should be of a material that will not retain filth within its pores; dressed stone, therefore, is objectionable, as also is wood. Enamelled fireclay or tinned copper seems to be the best kind of material for general use. The sink should be fitted on galvanised brackets fixed in the wall, which leaves the whole space below clear for easy sweeping and cleaning, besides being more convenient to work against.

Glazed brick piers and pedestals are preferred by some, and can, of course, be easily cleaned. Wood bearers or casings, however, should never be used.

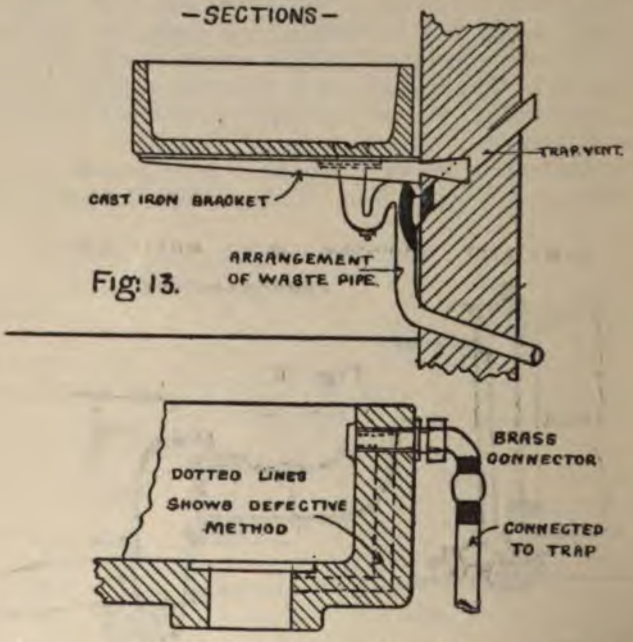


Fig: 13.

The back (and side also if fixed in a corner) should be carried up the wall some 9 inches, to prevent splashes from dirty, black and greasy water accumulating between the back of sink and wall, with a result that can readily be imagined.

It is frequently remarked that a sink discharge pipe is so short, as a rule, that no trap is necessary—indeed is only an impediment—whilst to allow a passage of air through the pipe is a distinct gain.

I can fully endorse the latter portion of such an argument, providing the air is made to pass to the outside of the house.

But to pass air into the house through a dirty waste pipe immediately under the nose of a servant who may be preparing articles of food, is to my mind a practice which cannot be defended.

Should any person be in doubt as to impurities the air can take up on its passage through such a pipe, I would suggest that they passed their handerchief down, after which process, I venture to think, they will have visible proof.

The deservedly condemned slipped-putty joint is the general means of connection for the waste pipe. A proper brass fitting with coupling for soldered joint, however, is just as necessary for a sink as a bath or lavatory, and it is difficult to find any other reason than indifference on this subject to explain why they are not always used.

In concluding, I am aware that my remarks may not be altogether new to many present, but the fact that there exists so much indifference, and so many bad appliances in use, is, I think, sufficient excuse for bringing this subject before the Congress.

Who is responsible for the present deplorable state of things, and how can they be best remedied, are queries that require an answer.

The growing desire to obtain everything on the cheap, including our health, has led to a most unjust system of competition amongst many of those responsible for the conduct of this branch of engineering, resulting in inferior workmanship and material being used.

The chief fault however, in my opinion, rests with those charged with the responsibility of protecting the health of the community against such evils. The present duties of "Sanitary Authorities" fall far short of the requirements of the times. It may be that they are not provided with the legal power necessary to enable them to carry out their duties as they could wish; it may be that their duties are too numerous to be effectually attended to; or that many of them have never had the training necessary to enable them to properly carry out the Sanitary Engineering branch of these duties. Be that as it may, the fact that defective and dangerous arrangements are being daily exposed, on *new* as well as old buildings, proves conclusively that the public health has not yet got that protection it should have.

Whilst admitting freely that much has and is being done by this valuable institution, assisted by the Medical profession and others, to remedy existing evils, I am of opinion that a stronger influence for prevention is necessary, and that the time has arrived for the creation of a New Government Department, or "Central Board of Health," to whom should be delegated all questions relating to domestic sanitary construction, including the selection or otherwise of sanitary appliances generally, with power to issue bye-laws for the guidance of Sanitary Authorities, and to restrict arbitrary (though oft-times well meant) judgments of individuals, water companies, and others. By this means some uniformity of practice throughout the Kingdom would be secured.

The duties of Sanitary Inspectors are now becoming so responsible and important, that ample remuneration should be offered with a view to the public securing the services of thoroughly qualified and specially trained engineers, and who should be clear of undue local influences.

[*This discussion applies to the Papers by* Mr. J. OSBORNE SMITH Mr. LOUIS HANKS, *and* Mr. W. E. BLAND.]

THE CHAIRMAN (Mr. D. Balfour, Newcastle-upon-Tyne), referring to Mr. Bland's paper for a moment, said surely there were few water companies who would insist on providing a two-gallon flush only. Bye-laws and other enactments ought to prevent anything of the sort being possible. As to soil-pipes, he thought they ought always to be outside, and never inside, as he had noticed them in several parts of Paris quite recently. The ventilation opening in closets, he thought, was often overlooked in the administration of bye-laws. There should be a full and permanent opening at the ceiling, as the Local Government Board embodies always in bye-laws.

Dr. HERBERT JONES (Crewe) said he should like to say how very opportune was the paper upon the construction of elementary schools, for the Education department appeared to be sanctioning plans for buildings which were not in accordance with some of the conditions which most of them considered were necessary. Take one point which was emphasised and which could not be too strongly insisted upon, that all windows should reach the ceiling level, for in more than one instance which had lately come under his notice this important requirement had been entirely ignored. He could not agree so cordially with the Author when he advised that windows should only be upon one side of the room, to the left of the pupils, undoubtedly the proper position; but if the room is a wide one, one-half will receive little or no sunlight, more especially if the street is narrow, or if opposite to the schools there are high buildings. He was sorry that Mr. Smith said nothing about the construction of the floor of the playground; this was a very important point, for if any substance such as ashes were laid down, the ground got very dirty in wet weather, and in dry much dirt and dust would be carried into the school. There must be an impervious and hard substance for the floor of a playground. He was sure all would agree with the Author that for purposes of ventilation there should not be a heavy wide sash window too heavy to be readily raised. He was glad also to hear the protest against sunken hot-water pipes placed beneath a grating. How this was ever allowed to be done in public buildings he could not imagine, yet the condition prevailed not only in schools but in public halls, and very constantly in churches, indeed he had noticed such an arrangement only yesterday in the Cathedral at Newcastle. There was no doubt that tuberculous matter must often have got deposited in those channels, for a man with a tuberculous cough not caring to expectorate upon the floor of the church, would not hesitate to spit on to or beneath a grating, where there would be an excellent nourishing ground for the bacillus, which would be inhaled in turn by a subsequent worshipper, and thus the circle completed. Referring again to the subject of ventilation, he thought that in those towns where electric power could be had they might very properly use electric fans; the cost was not great, they were very readily set in action, and extracted the foul air from a room very speedily.

The Rev. P. C. FORTIN (Lanchester) said that he had not heard the whole of Mr. Osborne Smith's paper, but he quite agreed with him that to obtain the maximum of light the windows should go up to the ceiling, and also that they should be only on one side and end, or ends of the school. He could not agree with the last speaker, who was in favour of windows on both sides, as this had an injurious effect on the eyesight of the children. He spoke from some little experience; for twenty-five years he had been manager of three different schools, and ought therefore to know something about the matter. In two of the schools the children sat with their backs to the light, and faced a wall on which were hung maps, pictures, &c. In the third school, on account of the position of the door, the children sat facing the windows, and his attention was drawn to the number of children who suffered from weak eyes and defective eyesight. He found upon examination that the number of such cases were greatly in excess of those from the other two schools put together. Thinking the matter over, he had come to the conclusion that the evil arose from the fact of the children having constantly faced the light. He had had the desks therefore re-arranged in such a way that the children sat with their backs to the windows, and he was happy to say with very successful results. There were now no complaints from the children about their eyes; they did their work much better than they did under the old conditions, more particularly as regarded writing and drawing. Raising their eyes from their books or papers, they were rested by looking at the wall opposite, and this would have been impossible if the light had come from both sides. Above all things clouded or obscure glass should be avoided, as it had a most depressing and bewildering effect upon the children. It had been suggested that the school desks might have been placed in various positions according to the windows, but a very little practical knowledge of school work would soon have shown that this was impossible, as the classes would have been broken up, and the teacher would have lost command over the school. For elementary schools, the regulations issued by the Education Department would generally be foundamply sufficient.

Mr. Moss FLOWER (Bristol) said he had listened with a great deal of interest to the papers read by Mr. Hanks and Mr. Bland. He could endorse all that Mr. Hanks had said, and considered that most of the suggestions made as to the fittings of stables were very good. Mr. Bland made a suggestion as to carrying of sewer-ventilating pipes up the sides of churches. That, on the surface, looked a good plan, but he feared they would find a good deal of sentiment in opposition to it. In building new churches the thing might be arranged. Mr. Bland concluded his paper by referring to the fact that incompetent men were often appointed sanitary inspectors. He knew this was so in many instances, but he thought that Mr. Bland would agree with him that it was practically impossible, with the small staffs that we had in our towns and districts, to get perfection by inspection. It seemed to him that we could only get this by educating the public, and setting forth at all times a good standard of work. The employment of a good number of efficient sanitary inspectors would, of course, go a long way to bring this about.

Mr. ROGERS FIELD (London), said he agreed with the last speaker that what was now wanted more than anything else was that the public and the Local Sanitary Authorities should be properly educated in the right way of looking at these matters. That was one great object of the Sanitary Institute; and he thought that the paper by Mr. Bland was the very sort of thing wanted to educate the public and Sanitary Authorities. At the end of Mr. Bland's paper he asked why it happened that if there were very good bye-laws on this subject that they were not put into force. He thought it arose chiefly from ignorance. Members of Sanitary Authorities thought these were small details, and did not see the importance of them. But if it were pointed out, in the way suggested by Mr. Bland, that some of these matters which seem so trivial may mean the difference between good sanitation and bad sanitation, he thought that the authorities would take them up, and see that they had proper bye-laws, and that they were carried out. He was disinclined to say much about details, because one ought to study the paper carefully before giving an opinion. But there were one or two things that he should like to mention. There was the question of using cast-iron pipes for drains, which was becoming a very important one. For the last 20 years he had devoted himself very largely to the question of the drainage of large institutions, such as hospitals, asylums, schools, as well as of houses. For many years he never used iron pipes except where drains passed under buildings, and then he always used them. In ordinary cases he used stone-ware drains, laying them on concrete, and jointing them in the best way that he could. It had frequently happened that after a lapse of years he had been asked to examine and test the drainage again, and his experience in this connection had very much altered his opinion as to stone-ware drains. In a large number of cases where stone-ware drains had been laid in the best way, and left absolutely water-tight, he had found that when re-tested after such lapse of years, they were leaking, whereas in no single instance had he found an iron pipe which was not sound. That experience had induced him lately to use iron pipes very largely. In fact, in many large institutions every drain he constructed was of iron pipes, and the first cost was not so much greater, as one would think, than that of well laid stone-ware drains. Mr. Bland said if iron pipes were going to be used there ought to be rigid regulations with regard to size and weight. To this he quite agreed. The iron pipes that he had been speaking of were heavy ones of cast iron, properly coated, and they lasted admirably. But if in Specifications they merely mentioned "iron pipes," without stating details, builders would get very light ones—and even rain-water pipes—and the consequences would be worse than the condition of things they sought to remedy. Again, Mr. Bland mentioned grease traps, in which grease collected and remained until some person came and cleaned them out, in order to prevent the matter getting into the drains. He soon found that these grease traps were abominable things, from which the most offensive smells arose. He had to give them up, and to take to the modern practice of putting the grease into a large receptacle in which it would cool, and then flush it out by an automatic flushing tank.

Mr. **Archibald Dunn** (President of the Northern Architectural Association) said he was sorry to have to say that he could not agree with some of the observations that had fallen from Mr. Rogers Field on the question of drainage. The large question had been raised as to whether iron pipes should be used instead of earthenware pipes. He thought if ever that were adopted it would be a great misfortune. He thought it would be found, if the experiment were tried, that iron pipes did not last as long as ware pipes. He had examples of the latter which had been buried in the ground for centuries, and which, upon being taken out, were found to be as fresh as they were when they were put into the ground. He had little hesitation in saying that they had no examples of iron work—cast or wrought—of which the same could be said. He was one of those who thought that they used far too much iron in the construction of their buildings, and he thought if iron pipes were substituted for earthenware pipes for sewage purposes it would be a great misfortune. He thought the time would come when some structures of iron, such as our bridges, would have to be replaced to prevent falling. The deterioration of iron could not be got over, his own opinion was even if iron pipes were enamelled and all precautions taken, it would be a great misfortune to adopt the change referred to.

Mr. J. Osborne Smith (London) said he was extremely grateful for the cordial way in which his notes had been received. He did not know that there were many matters calling for explanation; but he would like to have made quite clear what was meant by windows on one side of the room, because on that point experience had taught him to hold strong opinions. A class room should be mainly lighted from one side—the side on the left of the children—and it was quite possible, no matter what might be the size of the room, to adequately and thoroughly light it from one side. He had seen class rooms with windows put in to avoid a blank wall, and not at all necessary for purposes of lighting. The reversing of desks would be difficult in a properly-managed school. The schools he had been referring to were not elementary schools, with large class rooms, but secondary schools, with rooms for 30 to 40 pupils. He did not think the suggestion as to the desks would be workable in such a school. As to the floor of the playground, it should be impervious. A gravel floor was a great nuisance in a playground. Something had been said about electric fans for improving ventilation. He had in the course of his experience to take out a number of mechanical appliances in secondary schools because they did not get properly looked after. He would like to say, with reference to one of the other papers, that he could corroborate very strongly the remarks made by Mr. Rogers Field about grease traps. They were things that ought never to be put in at all now, unless connected with a flush tank. It was a rare thing to find them anywhere now. They used to cause a great deal of annoyance and inconvenience. He would also like to say, with reference to the exposing of pipes, that all pipes, including gas-pipes and water-pipes, should be exposed. It was often a terrible nuisance to find pipes buried in plaster.

Mr. Louis Hanks (London) thanked them for the kind manner in which they had received his paper. It had not provoked any expressions of dissent, so he ventured to conclude that it had found acceptance. While we were thinking so much about the sanitary surroundings of human beings, he thought it would not be out of place to consider those of animals. Possibly he dwelt too much on the sanitary fittings of stables, but he wished it to be understood that his remarks applied equally to cow-houses, for they were of great importance.

Mr. W. E. Bland (Newcastle-upon-Tyne) said there was one thing which had given him satisfaction and that was that his paper should have been criticised by so able a gentleman as Mr. Rogers Field. Being Lecturer at the Durham College of Science, it was absolutely necessary that he should get his information, as far as possible, from facts and experience. The information would naturally be acted upon in the course of time as students got older and it should be correct as far as it could be obtained. With regard to grease traps he would call attention to an ordinary yard gulley which was usually fixed, he thought, to collect greasy sediment from the ordinary house sink. With Mr. Rogers Field and other gentlemen who had spoken, he fully agreed that the principle was wrong. He had seen as much as four to five gallons of sediment (of the most objectionable nature) taken from fittings of that description. He wished most strongly to endorse the opinion that they were the wrong sort of fittings to use, although they were at the present time being fixed in large numbers, and to really good houses. Grease traps should only, he thought, be used in exceptional cases where a large quantity of grease was likely to collect from the preparation of savouries, sauces, &c., and stop up the drains. The principle of breaking up the grease by a flushing tank was the right one to adopt in all cases where they were used. With regard to the tray below valve closets, he particularly stated that valve closets should be of the pedestal kind, without wood casing. Consequently no tray was necessary, as any splashing would fall on the floor and be washed up as it occurred. The tray was objectionable, as it always got splashings from the closet and became offensive. Where they had a pedestal closet there was no necessity for a tray under it.

A MEMBER: How do they get over the difficulty of placing a valve closet on a boarded floor without a tray?

Mr. BLAND said it was advisable to have the floors of all closets prepared of such a material that splashings were not likely to sink in. With regard to the question raised as to Sanitary Inspectors and their staff being frequently too limited, what he desired more particularly to suggest was that the sanitary engineering branch of the present inspectors' duty had recently become so important, that it would be better to place it in the hands of thoroughly qualified Sanitary Engineers, who would be under the direct control of a new Board of Health. By that means undue local influence would be removed, and he thought greater protection to the public would be obtained by a higher class of work. He could only express his sincere thanks for the manner in which his paper had been taken up.

"*On the Ventilation and Lighting of a Church*," *by* JOHN T. BRODIE, Assoc.M.Inst.C.E.

(MEMBER.)

THIS paper gave a general description of the church of Holy Trinity, Whitehaven, with details of the ventilation by means of eleven fixed hoppers in the windows and seven outlet ventilators in the ceilings. The installation of electric lighting in the church was also described.

[*For discussion on this paper see page* 560.]

On "The Diameters and Inclines of Drains and the Flush, etc., necessary for Household Purposes, together with the results of Actual Experiments made by the Newcastle and Gateshead Water Company in conjunction with the Northern Architectural Association," by ARTHUR B. PLUMMER, F.R.I.B.A.

ABSTRACT.

IN March of this year, as Hon. Sec. of the Northern Architectural Association, I received a letter from Messrs. Oliver and Leeson, Architects, drawing my attention to the fact that the Newcastle and Gateshead Water Company were again requiring in their revised regulations (then issued), that service cisterns in connection with W.C.'s should not allow of a flush of more than two gallons. I was desired to get up a memorial amongst architects and others requesting that four gallons might be allowed. Previous to taking any steps in the matter I called upon Mr. Smith, the Secretary, who at once kindly went with me to the Company's yard at The Manors, Newcastle, in order to introduce me to Mr. Askwith and to draw my attention to excellent fittings and cisterns recommended and used by the Company.

With the use of such fittings it was reasonably maintained that a two-gallon cistern was all that was necessary for flushing purposes within a residence, and it was mentioned that water companies were not required to provide water for flushing drains outside a dwelling but simply for domestic purposes.

The representatives of the Water Company next invited Mr. Leeson and myself to a further interview at The Manors' Yard, and thereupon very kindly arranged to fit up various cisterns and W.C. fittings, and lengths of drains for our further private inspection before inviting the members of the council of our Association to give the matter their consideration. On May 29th, Mr. Leeson and I spent a morning at the Manors' Yard, together with Mr. Alfred L. Forster and Mr. Askwith of the Water Company. We made a number of experiments and tests in connection with the various apparatus then fitted up.

There were two lengths of drain laid (each about 83 ft. long). One length was formed of 6 in. drain pipes, with a fall of 1 in

40, having a Buchan Trap 19 ft. from where the drain gradient commenced, with an obtuse bend at 12 ft. from the discharge mouth of the drain.

The second length was formed of 4 in. glass lined pipes, with a fall of 1 in 60, having a Buchan Trap at 6 ft. from the start of the drain gradient, with a right angle bend at about 12 ft. from the discharge mouth of the drain. (See Plans, p. 557, and Tables, p. 559.)

Various w.c. apparatus were fitted up in connection with these two lengths of drain, and were placed at heights representing the ground and first floor levels of a dwelling house.

We *first tested* the 6 in. drain with a ground floor Shanks' two-gallon flush syphon cistern with a 1¼ in. flush pipe. The distance from the water line in the cistern to the top of the wash-down basin was 3 ft. 8 in., and from the top of the basin to the bottom of the pipe where the drain gradient commenced was 3 ft. 8 in. A mixture of soft soap and sawdust weighing 10¼ ozs., without paper, was placed in the basin. The first flush cleared the basin, but it was not till the sixth flush that half the charge came out at the mouth of the drain, and at the eighth flush the remainder came out.

We carried out eight other similar courses of tests with various flushes, &c., detailed particulars of which have been retained. We noticed from the foregoing tests that although the 4 in. drain was not of so steep a gradient as the 6 in. drain, and although it also had a much more acute bend in it, the result of these experiments was decidedly in favour of the smaller drain pipe. Sufficient had been done during this morning's work to convince those present of the importance of these experiments; it was felt, however, that the only way to obtain exact results was to make a very large number of similar experiments in connection with each drain and apparatus, and to strike an average of the results in each case.

The water companies' representatives proposed that the Northern Architectural Association should send a representative to work in conjunction with their Company's agent in connection with these proposed further tests, and in accordance with this suggestion such arrangements as were desired were subsequently agreed upon.

I think we may take it for granted that no water company would desire to supply less water for flushing purposes than such an amount as may be the minimum quantity necessary. It would be undoubtedly penny wise and pound foolish to supply too small a flush, as in such a case two or more flushes would be found to be necessary, and would undoubtedly be used by consumers instead of one of adequate amount. Now that pedestal closets are being universally introduced, and are used at all times and for all sorts of household purposes, the much greater amount of water wasted and used than was formerly the case, becomes a matter of serious consideration for any Water Company.

I am clearly of opinion that all syphon cisterns are a mistake, so far as Water Companies are concerned, and they are not necessary from other points of view. Of course in the case of syphon cisterns, the full amount of the flush, say two gallons, is obliged to be used upon every occasion, whereas with other cisterns only half a gallon can be used if desired, and in many instances may be all that is necessary, on other occasions it is however, quite indispensable that the handle should be pulled till the full two-gallon flush is obtained.

Various architects have for a long time been convinced, that many local authorities often compelled drains to be laid of unnecessarily large diameters in connection with private properties, and have felt that if only such authorities could be convinced that such is the case, it would be a decided advantage. If the Water Companies' experiments help to prove that drains of as small a diameter as necessary are more easily flushed and kept clean with a minimum flush than drains of an unnecessarily large diameter (which more easily choke up and become foul), we may reasonably expect that some good will be the result of these experiments.

I know of instances where in the case of drains from even single W.C.'s, nothing less than a diameter of six inches will be allowed by local authorities. I may mention that the Education Department seem to understand the importance of not having large drains; in their Code of Regulations they state that four inches in diameter is sufficient to receive the discharge of as many as ten W.C.'s. I find that the bye-laws of the various local authorities in the north of England practically leave the question of the diameter to the discretion of such authorities. It is generally stated that "the drains are to be placed in positions, of such size and of such materials, and at such levels as may seem to the Council sufficient for the purpose of effectually draining the same," or else it is stated that "every drain shall be of adequate size, and if constructed or adapted for conveying sewage to have an internal diameter not less than four inches." It would seem to me to be desirable that the maximum as well as the minimum size of drains should be stipulated and considered, and that a regular scale of sizes of drains should be drawn up and included in the bye-laws (as in the case of the various thicknesses of walls); if such scale were not binding in every case it would at any rate be able to be

WATER COMPANY.

n Alternating

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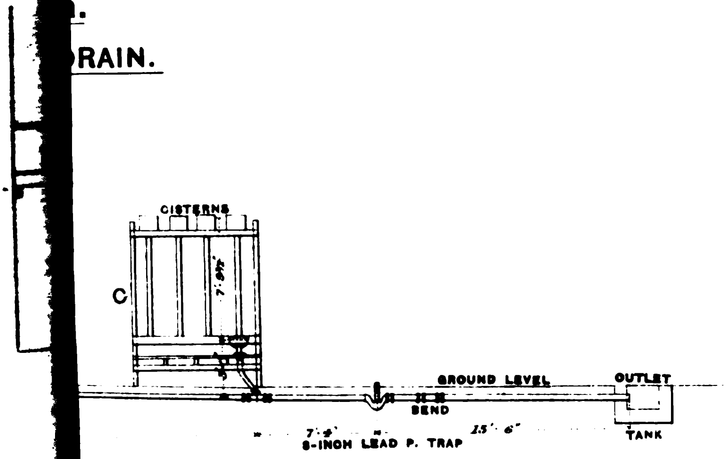
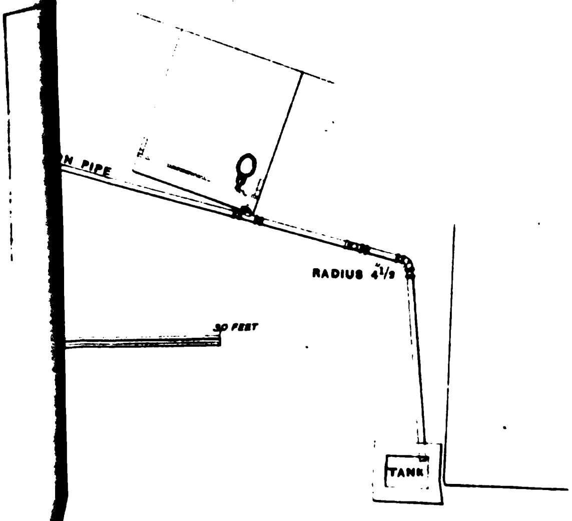
RAIN.





EAD WATER COMPANY.

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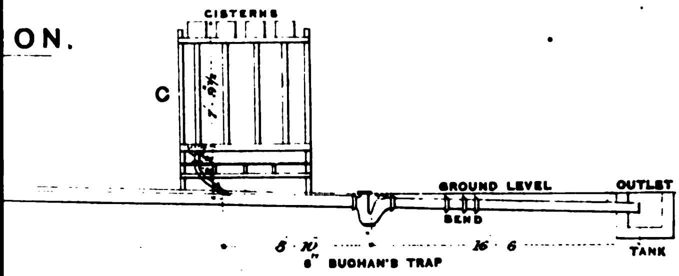
PIPE DRAIN.

ON.



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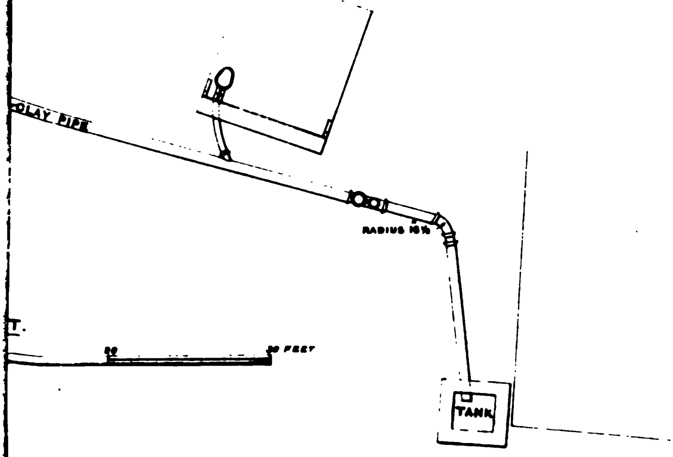


referred to as a guide by any council or architects as to how they should use their discretion.

I may perhaps mention that the London County Council made an application to the Local Government Board last year desiring that the flush might be increased from two to three gallons, the result of this enquiry was that the two gallon flush was adhered to. I am of opinion that two gallons is sufficient for satisfactory sanitary apparatus, but not enough for flushing large drain pipes laid to a gradient of from 1 in 40 to 1 in 80; of course many cisterns, nominally two gallons, contain either more or less than that amount. If consumers obtain water by meter, they can, of course, have a larger flush, and in certain cases this may be necessary, or else by some means they should have drains of a size and incline, &c., that can be flushed with the Company's allowance of water.

On August 11th a new series of tests was commenced, when four 82 ft. lengths of drain were laid to a gradient of 1 in 40, and alongside each other, viz.: 6 in. and 4 in. sanitary pipe drains, and 4 in. and 3 in. glass-lined metal pipes. Each length had an almost right-angled bend at 12 ft. from the mouth, at a further distance of 4 ft. there were Buchan's traps in the 6 in. and 4 in. pipes, and a Dubois' trap in the 3 in. pipe, at a further distance of 8 ft. there were four junctions in connection with yard conveniences, 58 ft. beyond the drains were connected with four soil pipes, each having connection with ground and first floor w.c.'s. All the cisterns were two-gallon, with 1½ in. flush pipes and Hopper basins.

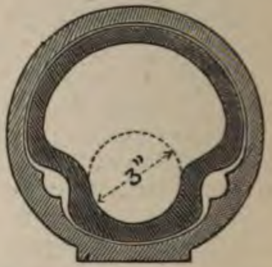
We started to experiment with the 6 in. drain by charging the top floor w.c. with a six ounce solid mixture of soft soap and sawdust, &c., as before, and flushing with two gallons, the same thing was next done in connection with the ground-floor closet and then with the yard w.c. We commenced again and continued in rotation as before till each of the three closets had been flushed and charged twenty times, after the fourteenth round the drain was entirely blocked. Of twenty-two and a half pounds put in only seven passed out. Considerable force was necessary with a hose-pipe next morning to clear this drain out again. Similar experiments in connection with the 4 in. sanitary pipe resulted in the charge passing much more freely through it till a stoppage took place at the end of the sixth round, and again a very considerable flush was necessary to clear the drain. In the case of the 4 in. metal pipes the results were satisfactory and the 3 in. metal were even more so, each charge practically came direct through the drain with each flush and it therefore became unnecessary to again test this drain under less severe circumstances.

It must be remembered that in allowing a two-gallon flush, the Newcastle Company are only doing what almost all other companies (who give the matter much consideration) in the kingdom do, with I understand the exception of Southend, where a two-and-a-half gallon flush is conceded. This was however agreed to before the date of the Local Government Board Inquiry, already referred to. This also is the case with Bradford where there is (or was) a three-gallon flush. I may however mention that there was a very serious water famine at Bradford two or three years ago. It would perhaps be possible satisfactorily to meet the requirements of water companies, and the present demands of local authorities, by having large drains of a V or egg-shaped section.

The drawing shows a section of drain-pipe proposed by me, which maintains the advantage of the circular exterior with the small and large circular interior for flushing and flood purposes; it also avoids the objection of being top-heavy and difficult to manufacture, as is the case with the otherwise excellent egg-shaped pipes.

In the drawing the darker portion represents the section of the spigot end of the pipe, and the outer lighter portion the section of the socket.

Another satisfactory course would be to convey waste water from baths, etc., to a flushing tank at the head of the drain, or where bath wastes can be conveyed direct there; no better flush could be desired under any circumstances.



We conducted a further series of tests at the water company's yard, allowing consideration for other water flowing in the drains between the use of the w.c.'s. The closets were therefore charged in the same way as before, and in the same rotation, but after each flush with the charge in it, each cistern was discharged a second time into the drain simply as water without any charge. In no case was this second flush of the nature of a 4-gallon flush at one time, because the first flush was allowed to be cleared through the drain and the cistern to

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NOTE.—Somewhat similar designs for drain pipes are illustrated in "The Transactions of The Sanitary Institute," Vol. IX., pp. 283, 292.—ED.

fill again before the second was discharged into it. In the case of the 6 in. drain the second flush had the effect of preventing the stoppage, as was the case in the former tests, and the 4 in. and 3 in. pipes worked satisfactorily.

A third series of tests, similar to the first, was conducted with a two-and-a-half instead of a two-gallon flush, with the result that the 6 in. pipe now worked satisfactorily, and it therefore became unnecessary to test the 4 in. and 3 in. pipes in this way. I am of opinion that wash-down closets are the best from a sanitary point of view, and for flushing purposes.

The paper was accompanied by twenty-two sheets of tabulated experiments, the chief results of which are tabulated below.

Throughout the series the general arrangement of the pipes and traps, and the position of the closets, was similar to that shown in the diagrams facing page 557. In each experiment six ounces of artificial fæces (solid mixture of soft soap and sawdust) and four pieces of paper were put into the closet pan, and the amount of soil and paper flushed into the manhole was taken out and weighed with the water it had absorbed. There are no data to show the relative weights of the material when dry and when wet, and, therefore, the proportion of the materials flushed out in each experiment, or series of experiments, cannot be ascertained. But as all the experiments were carried out in the same way, the results are comparable as regards the different pipes used.

Size of Drain and Quantity of Flush.	Position of Closet on Plan.	Numbers of Tests.	Weight of Material put in.		Weight of Material flushed out.	Remarks.
			oz.	Paper.	oz.	
6-inch Fireclay Pipe, 2-gallon flush.	A	20	120	80	5	In five cases the drain is noted as being blocked; in seven others that the water came through very slowly; and in one that the trap was filled with soil.
	B	20	120	80	...	
	C	20	120	80	102¾	
		60	360	240	107¾	
6-inch Fireclay Pipe. 2½-gallon flush.	A	20	120	80	74¼	In one case it is noted that the trap was filled with paper and soil.
	B	20	120	80	69½	
	C	20	120	80	279	
		60	360	240	422¾	

Size of Drain and Quantity of Flush.	Position of Closet on Plan.	Numbers of Tests.	Weight of Material put in.		Weight of Material flushed out.	Remarks.
			oz.	Paper.	oz.	
4-inch Fireclay Pipe, 2-gallon flush.	A	10	60	40	*Nil*	Against fourteen of these experiments it is noted that the drain was blocked; and in two other cases that the water was trickling or running very slowly.
	B	10	60	40	*Nil*	
	C	10	60	40	37½	
		30	180	120	37½	
4-inch Iron Pipe, 2-gallon flush.	A	20	120	80	101	Against one experiment it is noted that the drain was stopped; and in another that the soil was sticking.
	B	20	120	80	121	
	C	20	120	80	222½	
		60	360	240	444½	
4-inch Iron Pipe, 2½-gallon flush.	A	3	18	12	25½	
	B	3	18	12	22	
	C	3	18	12	24	
		9	54	36	71½	
3-inch Iron Pipe, 2-gallon flush.	A	20	120	80	149	In three consecutive experiments the drain was blocked, and the hose was turned on to clear the stoppage, which was found to be caused by a small piece of stick; and in one other case the water was running slowly.
	B	20	120	80	120	
	C	20	120	80	147	
		60	360	240	416	
3-inch Iron Pipe, 2½-gallon flush.	A	3	18	12	23½	
	B	3	18	12	20½	
	C	3	18	12	23	
		9	54	36	67	
Plummer's Pipe. (See Drawing, p. 5.) 2-gallon flush.	A	20	120	80	67¾	In all the experiments the materials put into the closet were flushed into the trap in the drain.
	B	20	120	80	114	
	C	20	120	80	185	
		60	360	240	366¾	

This Discussion applies to the papers by Mr. J. T. Brodie *and* Mr. A. B. Plummer.

The Chairman (Mr. D. Balfour) said, in reference to church ventilation, that they ought to have more facilities for sanitation as well as for sanctification. From Mr. Plummer's paper they found that no doubt water companies were obliged to consider the question of economy very considerably, but efficiency must at the same time be maintained. He called upon the meeting to give a vote of thanks to Mr. Brodie and Mr. Plummer for their papers.

Mr. ROGERS FIELD (London) said: Mr. Plummer's paper had greatly interested him, and he thought that the Northern Architectural Association did good service in having such a matter as that referred to, gone into, and that they might do further good service in the same direction. The question of the two gallons flush was one to which he had been forced to pay great attention. He quite agreed that there should be no waste of water, and that no more water should be used for flushing than was necessary for sanitary purposes, but he thought that the question must be looked at from the point of view of the public welfare. One of the chief objects of giving a water supply was that we might have good sanitation, and a sufficient supply should therefore be allowed for closets to carry away foul matter under the ordinary conditions which occur in practice. If it could be shown that a two-gallon flush would not do that, then he thought, in the interests of the public, that the quantity should be increased. His attention was first called to the question something like twenty years ago, when his practice in dealing with the reconstruction of the drainage and sanitary arrangements of buildings largely increased. He then used the two-gallon flush, as this was considered sufficient by the best authorities of that day. He took great care to get the best apparatus, and have it fixed in the best way; but, notwithstanding this, he gradually found that the closets did not clear themselves in actual practice as well as was expected. This led him to investigate the question very carefully, and he found that two gallons was running it much too fine—as, although this quantity acted fairly when everything was perfectly arranged and constantly attended to—a number of circumstances arose in practice which prevented this perfect condition, and then the two-gallon flush was not sufficient. He therefore increased the flush to two-and-a-half gallons whenever he could, and entered two-and-a-half gallons in his specifications. As his experience extended, and the greatly increased use of inspection chambers offered better opportunities of observing the flush, he became convinced that even two-and-a-half gallons was not sufficient, and for many years past he had adopted a three-gallon flush. With a three-gallon flush he had had no difficulty or trouble. The Sanitary Institute some years ago went very carefully into the question, and tried a number of experiments, and the conclusion come to was that a two-gallon flush was not sufficient. He had also had other opportunities of investigating the matter experimentally, but the conclusion he had come to with reference to experiments was that they did not show what took place in the ordinary conditions of practice. He did not say that one could not get experiments to show this, but he did say that no experiments yet tried, so far as he was aware, showed what took place in ordinary conditions. He would very strongly advise the Northern Architectural Association to gain information from their members of what they find takes place in practice. This is what engineers and architects wanted to know—not mere opinions, but facts. If the Association did what he suggested they would collect a body of valuable facts. There are many reasons why a two-gallon flush is not sufficient, and they were technical ones, which an architect would understand. If there were a nominal two-gallon cistern, it did not follow that the water flushed out of the cistern was two gallons; in fact, in practice it was generally less. The reason of this was that the ball cock was always regulated to keep the water in the cistern below the overflow, and often much below the overflow. In the same way a three-gallon cistern does not mean that three gallons of water are used in practice. It means that only about two-and-a-half gallons are used. Again, the two-gallon limit prevents the use of many excellent forms of valveless closets, which would not work with two gallons, even under the most favourable conditions. There was another point in the paper which was an important one. Mr. Plummer said, "It must be remembered that in allowing a two-gallon flush, the Newcastle Company are only doing what almost all other companies (who give the matter much consideration) in the kingdom do, with I understand the exception of Southend, where a two-and-a-half-gallon flush is conceded." Even in the case of Water Companies, Southend was by no means the only Company which allowed more than two gallons. If, however, instead of collecting statistics with reference to Water Companies, we were to collect statistics relating to Corporations and Local Sanitary Authorities who were themselves in charge of the water supply, we should find just the opposite—viz., that a very large number, perhaps more than half, adopt a two-and-a-half or three-gallon flush. Why was this? It is not supposed that the Sanitary Authorities wish to waste water. The reason must be that they find that it is to the interests of the public to allow such a flush.

Mr. OSBORNE SMITH (London) said: Having had rather exceptional experience in regard to plans where this question of the sizes of cisterns and flushing comes in, he had listened to Mr. Plummer's paper with a considerable amount of interest, and it had corroborated an impression which had been upon his mind for years past. He had often felt satisfied, although he had never been able to try the experiment, that a pipe even smaller than three inches would be ample for branch drains. To consider the difference between a 6 in. drain and 3 in. drain with all this matter put in them. The 3 in. drain would flush every time, whereas the 6 in. drain very often became stopped. He distinctly remembered some time ago seeing an old 4 or 4½ inch soil pipe taken down. It had probably been in the position whence it was removed, 100 years. He had no doubt that for the last fifty years the soil had been passing through 2¼ in. It was highly polished and the sides were as hard as ebony. This and other things had shown him that we were going in the right direction in insisting on small pipes, and these experiments coming after the decision in London about the two gallon flush, made it quite clear that a two gallon flush was not such a bad thing as it was made out to be. He had to examine periodically many High Schools where girls attend in large numbers, and girls, as is known, use closets very much more frequently than boys. Take a range of a dozen closets in a school; girls come out for recreation, and all the closets are used at once. As soon as one girl leaves a closet another goes in; and it was very inconvenient if the flushing cistern was not ready to discharge at once when required. He made his cisterns fill in half-a-minute when they were in use. At some schools he had found by experience that a two gallon cistern answered its purpose well if the water pipes were made large enough. An ordinary two-gallon cistern answers every purpose, and can be made to fill in half-a-minute. And that was the important point. In ordinary cases it does not much matter if it takes two or three minutes, but in schools and places of that kind where closets are used rapidly, it was very necessary that they should fill rapidly. The experiments that had been carried out did not point much to the doing away with 4 in. drains, because there must always be something approaching that to carry off surface storm water. But for drains that convey soil only, he was convinced that a 3 in. pipe was ample.

Mr. W. E. Bland (Newcastle-upon-Tyne) said, in reference to a remark of Mr. Plummer's which seemed to imply that water companies were now on the road down to a two-gallon flush, instead of up to a larger quantity, that he wished to record the fact stated to him by a Glasgow councillor recently, that the City Engineer, Water Works Engineer, Medical Officer, and Sanitary Inspector of that city had put their heads together and arrived at the conclusion that two gallons was not sufficient, and now allow three gallons instead of two. This showed a tendency rather upward than downward. Seeing that the chief object of water companies, in seeking to reduce the quantity to two gallons, was to save water, he would suggest that they try to save it in other directions, for instance, much cold water was run to waste uselessly through baths, lavatories, and sinks before the hot water arrived at the tap, where the hot-water supply was not properly arranged. They might endeavour to save this waste, instead of taking from the supply to water closets where it was really needed.

Mr. F. Hooper (London) said that he was representing the Architectural Association of the South of England, and was glad to know that their allies in the North had undertaken so valuable a series of experiments as those that had just been explained. We feel great diffidence in even referring to a matter which had been treated so largely by Mr. Rogers Field. But might they not think that the experiments which had been conducted in the North by Mr. Plummer and his confrères were even of a higher standard than Mr. Field would give them credit for? The difficulty of dealing with sewage was so enormous, and the diluted character of the sewage at its outfall so remarkable that anything which would reduce the volume of it was of the greatest importance, and he thought it would be a pity if, in the year 1896, they were to set forth a belief that a three-gallon flush was the minimum, especially as their successors might find that a far less volume was ample! If Mr. Plummer could manage by any improvements in the forms of pipes, and by adjusting the proportions of the sections more accurately to their requirements to make a small supply sufficient, he would deserve far more thanks than those who urge a greater expenditure of water.

Mr. J. **Munce** (Belfast) said he thought the whole tenor of Mr. Field's remarks showed how useless the experiments were which he made some years ago. Mr. Field first thought that a two-gallon flush was quite enough, but when he went to inspect some closets fitted up under his direction with two-gallon cisterns he found the drains stopped, and he decided a two-and-a-half gallon flush was necessary; to-day he advocated three gallons, probably next year he would advise four gallons. This first showed that much of the discussion here was merely the opinion formed at the moment without careful study. He stated this after eleven years' experience of Sanitary Congresses. A pipe prepared with much care had been laid before them by Mr. Plummer, who must have put himself to great trouble; but with the exception of the last speaker no one had attended to it. A good deal of courage was required to bring a new pipe before such a meeting. For years he had had charge of large numbers of drains from public buildings and dwellings, and the experiments detailed by Mr. Plummer were just his experience; drains stopped a few yards from closets simply because the flush was insufficient to carry the contents of the water-closet through the disconnecting trap. Some new form of pipe must be devised, or this stoppage would go on. He did not know whether the experience of other members was like his own as to disconnecting traps, which were to a large extent sources of danger, especially if put to every house without sufficient water to flush each time a closet was used. In Belfast owners of property complained of constant stoppages from insufficient flushing, and three gallons were used. The pipe shown by Mr. Plummer would not necessarily involve the alteration of all the drainage systems because the sockets could be fitted to ordinary drain pipes, and the new pipe could be used from time to time as renewals were made.

Mr. A. **Dunn** (Newcastle-upon-Tyne) said: They had listened to an invaluable paper—a paper dealing with the results of absolute experiments fairly carried out by Mr. Plummer. He had listened to the paper with the greatest possible satisfaction, and thought that Mr. Plummer had established one or two things worthy of notice. He seemed to have established that a smaller size drain was the most useful for household drains and that a two-gallon flush was too little. These two facts ought, the speaker thought, to go forth from this Institute as well-established by the experiments of Mr. Plummer. He thought Mr. Plummer had shown a new form of drainage pipe which met a great difficulty. It answered its purpose not only with a smaller flush but with the large supply which comes from the rainfall. There was another thing, which was not mentioned, but which he thought was absolutely necessary for making household drainage absolutely perfect, and it was that the cistern in a house should have attached to it a small flushing tank. This might be a little expensive, but these experiments all showed that a flushing tank, in addition to the other conditions, would make the system of household drainage almost perfect.

Mr. C. H. **Cooper** (Wimbledon) objected to the section of pipe proposed by Mr. Plummer, as each time a drain made with these pipes was flushed, deposit would be left to accumulate on the shoulders on either side. In the case of egg-shaped pipes no such objection could be raised, but these pipes would not keep their shape during burning. Even circular pipes were difficult to keep in shape during burning, and he (Mr. Cooper) did not believe it practicable to burn pipes of the sections shown by Mr. Plummer, and he should much prefer to see actual burnt pipes to models.

Mr. T. J. **Allen** (Newcastle-upon-Tyne) said that manufacturers preferred the circular pipe; it was more easily handled. But there was no more difficulty in burning the other. They could be placed in the kilns and they would carry just as easily. They were all of equal thickness, and manufacturers were prepared to make them. He could not say that these pipes would be more easily made than circular pipes, but they could burn them as truly as circular pipes. The egg-shaped pipe was difficult to work with. They had made them, but did not care about making them.

Mr. J. T. **Brodie** returned thanks for the way his paper had been received.

Mr. A. B. **Plummer** (Newcastle-upon-Tyne) said: The fittings and lengths of drain, referred to in his paper, were still to be seen in the Water Company's Yard, and they would be glad to have them further tested. With regard to Water Companies' allowance of two gallons, he wished to say that he was speaking of Water Companies, and not (as has been suggested) of Local Authorities who had themselves charge of the water supply. He found that where water was superabundant there were a few more companies supplying more than two gallons than he had been aware of, but they could not be forced to supply more than the two gallons. They were faced with this difficulty, in most cases they could not get more than two gallons, which would only satisfactorily flush small drains, and Local Authorities, for various reasons, frequently insisted upon larger drains. But he did not say pull up all the present drains. What he said was this, why should they not in new work, try to get over the difficulty they were faced with, by means of a drain pipe such as he proposed. It was a question of necessity.

SECTION III.

CHEMISTRY, METEOROLOGY, AND GEOLOGY.

PAPERS AND DISCUSSIONS.

On "The Bacterial Examination of Water and Sand Filtration," by PERCY FRANKLAND, Ph.D., F.R.S., Professor of Chemistry in Mason College, Birmingham.

THE bacteriological methods devised by Robert Koch in the year 1883 have practically placed the study of bacteria within the reach of all, and the immense strides which bacteriology has made in such various directions, is principally due to the introduction of these methods which have enabled such a large amount of accurate information to be secured with comparative facility.

One of the most important sanitary applications which has been made of these gelatine-plate-cultures is undoubtedly the examination of drinking water, and I think, that, without exaggeration, it may be said to be now practised in every quarter of the globe.

In the general rush after bacteria which followed the opening up of this new domain of work, it was inevitable that some rash assumptions should be made, and unjustifiable anticipations entertained; it was not uncommon, for example, to hear the chemical analysis of water decried, whilst the bacteriological examination was declared to be capable of furnishing an answer to every question in which health considerations were concerned.

We hear of water samples purposely inoculated with typhoid germs pronounced by the chemical expert as pure, whilst the bacteriologist by his methods was able to detect the typhoid bacillus and condemn them in consequence.

Such evidence, if accepted without further consideration, might very easily mislead the public, not only as to the relative but also as to the actual value to be placed upon the chemical and on the bacterial examinations of water respectively.

In the above "test" of the respective merits of the chemical and bacterial enquiry, it must be remembered that such a sample of water, purposely infected with a pure culture of typhoid germs, could certainly not be found in practice, and that the conditions under which it was prepared, whilst eliminating all the materials upon the presence of which a chemical opinion could be formed, such as sewage contamination, presented the bacteriologist with all he could desire for the easy diagnosis of a typhoid infected water.

In a paper which I read before the International Congress of Hygiene in London in 1891, I drew special attention to this point, and the following extract may perhaps not be out of place here :—

"It is frequently urged in some quarters, that the ideal object of the bacteriological examination of water is to discover whether or not pathogenic forms are present. Now, although such an enquiry may occasionally be of great importance, it cannot be sufficiently emphasised that, as a general rule, it is wholly irrelevant to the purposes of water-examination. Under ordinary circumstances, potable waters are submitted to experts for examination, with a view to the determination of whether or not they can be used with safety for domestic purposes. Is the answer to this question to depend upon whether pathogenic forms are discoverable or no? Surely the object of the water-examiner is primarily to ascertain whether the water is subjected to influences which may at any time lead to the introduction of pathogenic forms, and only subsidiarily to whether there are pathogenic forms present at the moment of the examination. In other words, the first object of the examiner is to find out whether the water is contaminated with sewage, and not whether the particular sewage contained pathogenic forms or not. The modifications introduced into the ordinary method of examination which have led to the occasional discovery of the typhoid bacilli in drinking-water are of great importance, as having thrown light upon the manner in which typhoid can be conveyed by water; but they ordinarily find no application in the case of enquiries made for the purpose of adjudicating upon the fitness of water supplies for domestic purposes. The real future of the bacteriological method lies in the possible discovery and easy recognition of micro-organisms absolutely characteristic of sewage, irrespectively of their pathogenic character. It is because the bacteriological method in its present state of development is of little or no assistance to us in this discovery of sewage contamination, that our opinion as to the presence or absence of such matters in potable water must still hinge upon its careful analysis, combined with a searching inspection of the environment of its source."

The supposed antagonism between the chemical and bacterial methods of water examination is entirely due to a misconception as to the separate functions which each method is capable of discharging.

The bacterial examination of water enables us to attack and solve problems on which the purely chemical expert can throw no light; on the other hand the chemist can teach us what the bacteriologist cannot. The two methods do not supplant, but rather supplement each other.

Perhaps the most important service which water-bacteriology has conferred upon sanitary science, is the insight which by its means we have obtained for the first time into the hygienic value attaching to various purification processes, notably the time honoured practice, now more than half a century old, of sand filtration.

What is now an old story, and recognised all over the world, was a novelty when in 1885 I published the first numerical results obtained in the examination by means of Koch's gelatine-plate-cultures of the London waters before and after filtration. The results which I had obtained were quickly followed by the publication in Germany in the following year, of similar investigations which had been simultaneously carried out at the Berlin Water-works.

The results of these bacteriological examinations were wholly unexpected, for chemical analysis had caused very little favour to be bestowed upon this process of sand filtration from a hygienic point of view, for chemically (as the following analyses I made of the river Ouse water, as supplied to York before and after sand filtration, sufficiently show), the water before and after passing through sand filters undergoes comparatively little alteration.

Chemical Analysis of Water of River Ouse before and after Sand-filtration. (Percy Frankland.)

		Parts per 100,000.	
		River Water.	Ditto after Sand-filtration.
Total solid matters		28·40	26·20
Organic carbon		·123	·119
Organic nitrogen		·025	·022
Ammonia		0	0
Nitrogen as nitrates and nitrites		·077	·089
Total combined nitrogen		·102	·111
Chlorine		1·6	1·6
Hardness	Temporary	11·5	10·9
	Permanent	7·1	7·1
	Total	18·6	18·0

Such slight chemical improvement as is here shown, indicating that sand-filtration had comparatively little effect on the dissolved matters in water, led to an *à priori* speculation that it would be unlikely to remove bacteria and other minute forms of life.

What such filtration, however, when efficiently carried out, accomplishes in respect to the bacterial character of a water is now familiar to all, and may be represented, as is well known, by a reduction of as much as 99 per cent. of the microbes originally present.

That such minute microscopic particles of life could be removed by or find an obstacle to their progress through, the filter by, such relatively large objects as grains of sand, not unnaturally gave rise to much speculation, and numerous enquiries into the mechanism whereby this remarkable result was achieved rapidly followed one another.

Thanks to investigations of the most varied character, we are at present fairly conversant with the conditions upon which efficient filtration depends, and although there is still some difference of opinion as to the precise value attaching to individual factors, yet there can be no doubt that the water-engineer is now in a position to regulate the working of his filters on sound scientific principles, instead of being dependent upon the "rule of thumb" methods which so long were his only guide.

How important a barrier may be placed between the consumer and disease by efficient filtration, can hardly have a better illustration than that afforded by the Altona Waterworks. In that case the River Elbe, from which that city obtains its water supply is, it is estimated, polluted, including its tributaries, by the *untreated* sewage of over four million people, whilst the watershed has no less than forty-six cities situated upon it which, with a permanent population upon the river-boats, brings up the total number of inhabitants to at least 5,894,000. The sewage of only about 1,700,000 of these people is purified before being discharged into the stream.

The number of bacteria in this raw river water at the Altona intake fluctuates considerably, and sometimes reaches as many as 100,000 per cubic centimetre. The following table shows the working of the Altona filter beds during the greater part of February, 1893.*

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* Water Supply, Mason, New York, 1896.

Number of Bacteria per c.c. in the Water of the Altona Waterworks, February, 1893.

C = Cleansing of Filter.

February.	No. of Filter.										Pure Water Reservoir.	Raw River Elbe Water.
	1	2	3	4	5	6	7	8	9	10		
8	50	22	40	24	28	136	146	368	84	152	130	28,560
9	48	28	C.	32	54	194	152	182	64	122	72	44,140
10	108	50	88	20	28	120	98	110	58	112	126	42,160
11	68	60	76	78	36	140	C.	126	76	204	152	34,100
12	72	58	240	60	38	110	288	80	70	282	82	26,040
13	34	30	560	48	28	82	214	186	86	374	104	24,800
14	40	46	354	24	18	52	164	142	46	364	142	34,080
15	26	28	76	14	18	44	74	48	26	72	49	40,260
16	38	26	84	24	22	52	76	60	C.	120	78	25,420
17	20	36	156	C.	22	48	82	86	324	130	95	26,400
18	26	18	102	54	32	54	112	72	82	126	91	26,440
19	24	20	88	78	28	44	98	82	64	102	70	24,800
20	26	22	70	104	24	36	96	88	34	78	46	19,840
21	20	14	80	68	C.	34	96	44	30	152	50	34,720
22	34	C.	46	62	158	34	68	36	64	...	42	18,250
23	46	246	52	66	138	46	56	54	72	174	68	14,560
24	22	42	32	36	72	22	72	76	34	44	54	11,080
25	18	36	30	28	48	16	48	42	36	38	48	12,360
26	14	20	24	21	34	12	40	36	28	34	32	9,370

Thus the average number of bacteria present in the raw water during this month was 28,667 per c.c., whilst the average number present in the filtered water was 90 per c.c., which represents an average reduction of 99·69 per cent.

Of particular interest in the above table is the manner in which the cleansing of the filters, and consequent interference with filtration, is reflected in the filtrate, and this circumstance has led to the recommendation that the effluents from such filters should not in the first instance be admitted to the pure water reservoir, but should be run to waste until the filter has recovered its normal working capacity. This point has been further very usefully illustrated by Kümmel of Altona, who examined the filtrate before and after new sand had been placed upon the filter.

Before filling up	42	bacteria per cent.
One day after filling up ...	1880	,, ,,
Two days ,, ...	752	,, ,,
Three ,, ,, ...	208	,, ,,
Four ,, ,, ...	156	,, ,,
Five ,, ,, ...	102	,, ,,
Six ,, ,, ...	84	,, ,,

The splendid results achieved by the Altona filters in 1892, during the great Hamburg cholera epidemic are now a matter of history, but it is interesting to note how interference with efficient filtration has been reflected from time to time in the vital statistics of Altona. It is during the winter months that sand filtration has the greatest difficulties to contend with, for not only is the raw water as a rule more heavily charged with bacterial life,—a fact which I repeatedly showed to be the case in respect of the rivers Thames and Lee in reports made to the Local Government Board,—but the normal working of the filters is seriously threatened in the case of open filter beds by frost.

In Altona the satisfactory working of the filters has on various occasions been interrupted in the winter months during the prevalence of frost. The city has long suffered from mild epidemics of typhoid fever, sometimes, however, as notably in 1891, assuming a more serious character. In the ten years 1882–1892, there were five well marked epidemics of typhoid fever*; of these three occurred in February and two in March, whilst two smaller outbreaks were in December and January. Although typhoid fever usually declares itself in the summer and autumn months, Altona has never suffered at those seasons of the year, and there appears to be a very strong *prima facie* case for the connection of these outbreaks with the prejudicial influence of the frost on the efficient working of the sand-filters. It will be remembered also, in this connection, that Koch attributed an outbreak of cholera in Altona to bad bacterial filtrates during a period of frost, when filtration could not be carried on under the normal conditions.

Dr. Reinsch, who has made a special study of the Altona waterworks, states that the bad bacterial filtrates met with from time to time in the winter months, are due to the faulty construction of the outlets to the sedimentation basins, which permits the mud deposits to gain access to the filter beds, through disturbance of the mechanical arrangements by the presence of excessive quantities of ice.

It is particularly interesting to read in an official public health report of the Province of Schleswig-Holstein, published in 1870, that attention was already then called to an epidemic of *cholera infantum*, which broke out in Altona in the month of February. The cases were distributed throughout the city, and after careful inquiry the fact came out that for a few days in January the water company had supplied unfiltered water to the city. Dr. Kraus, who drew up this report, remarks:—"However little reason there may be to believe that there was a connection between these circumstances, future interruption of the service of filtered water should be most critically watched, as only in this way can reliable conclusions be arrived at." Already in 1874 Dr. Kraus advocated, when health officer at Hamburg, that sand-filtration should be resorted to for that city. Unfortunately, the construction of the filters was postponed until the Spring of 1891. Meanwhile the cholera epidemic of 1892 visited the city, creating such terrible havoc that a new impulse was imparted to the construction of the waterworks, and the latter were opened in May, 1893.

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* Hazen, The Filtration of Public Water Supplies, New York, 1895.

Whereas the old intake of the Hamburg waterworks was situated at a spot seven miles above the point where both its own sewage and that of Altona are discharged, the intake has now been removed to a point a mile-and-a-half higher up the stream, for there is no doubt that the tide did at times carry the sewage up the river to the old intake. Here there are 40 acres of sedimentation basins, and that these must contribute in no small measure to bring about the excellent results which have been obtained at the new Hamburg waterworks we know from the remarkable bacterial purification which takes place in such subsidence reservoirs. This removal of bacteria in such reservoirs I was able to demonstrate for the first time in the experiments which I carried out in the year 1892* for the London Water Companies in connection with the evidence which I gave before the Royal Commission on the Water Supply of London, and upon these observations I based my statement that "by employing suitable storage much of the flood water which is at present wasted might be turned to account."

That the Water Companies are now alive to the importance of this fact is evident from the large additional reservoirs they are adding to their works. Only a few weeks ago the West Middlesex Company opened two new reservoirs at Barnes capable of holding 350,000,000 gallons of water, equal to a supply for about twenty days, their former storage-capacity having been only 120,000,000 gallons, equal to a supply of about six days, and still larger works at Staines are contemplated in connection with other companies.

In addition to these sedimentation basins, the new Hamburg waterworks are equipped with eighteen filters, affording altogether an effective filtering area of about thirty-four acres. These filters are uncovered and are constructed to filter at a

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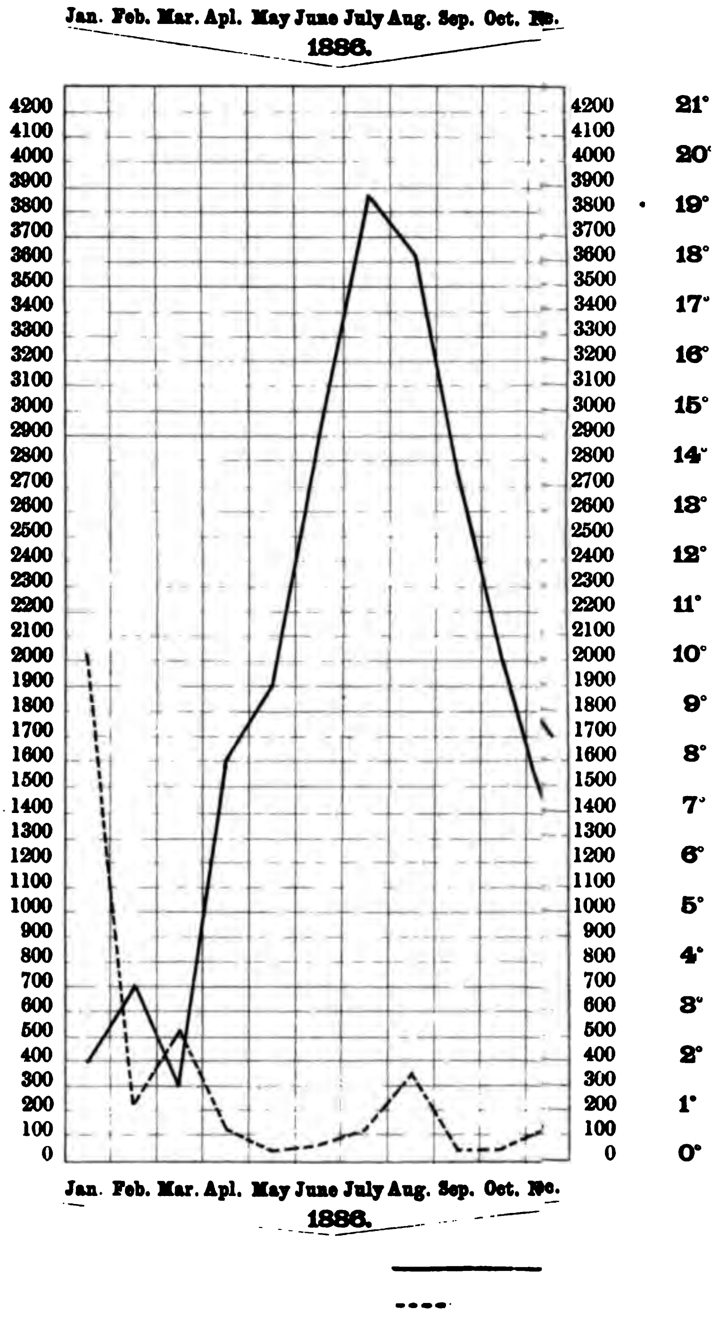
* See Appendices to Minutes of Evidence Royal Commission on Metropolitan Water Supply, p. 470. "Influence of Storage on the Bacteria in River Water." Eyre & Spottiswoode, 1893. Also "Centralblatt für Bacteriologie, 1893."

Diagram showing the relation betw



te of 1,600,000 gallons per acre daily. Upon two feet of avel rest 40 inches of sand, which is never allowed to be duced to less than twenty-four inches by scraping before ing refilled.

The filters have not been long enough in operation for reliable tal statistics to be gathered as to their efficiency, but it is said at since the introduction of filtered water, the mortality has en lower than has ever before been known in the history of amburg.

The city of Berlin also furnishes an interesting example of this parent connection between outbreaks of disease and inefficient tration. Frost has frequently interfered with filtration in at city, and some extremely suggestive tables have been drawn by Dr. Reinke which show that in March, 1886, March, 1888, ebruary-March, 1889, and February, 1891, the numbers of cteria in the filtrate were unusually high, the proper working the Stralau filters having been interfered with by frost, and at in every case these bad bacterial filtrates were followed by eatly increased death-rates from diarrhœal diseases. The erlin Health Office, moreover, has pointed out that this crease was confined to those parts of the city supplied from tralau, where open filters are employed, and that the districts pplied from the superior Tegel works, where covered filters e in operation, did not participate in these outbreaks.

In Zürich, again, extremely successful results have followed e introduction of filtration in 1886, typhoid fever having eadily decreased in the city; thus during the six years pre-eding the establishment of the new filtration works there was n average of 69 deaths annually per 100,000 living, whilst for e six years after, only one-seventh as many deaths from phoid fever occurred, a result which the local authorities tribute to the filtration of the water. In Zürich the un-overed filter beds previously in use have lately been superseded y new covered filters. It has, indeed, recently been suggested, ith much force, that all filters should be covered in localities here the mean January temperature is below the freezing oint of water.

The Hamburg cholera-epidemic of 1892, which swept away nsiderably over 8,000 inhabitants, and did incalculable amage to the commercial prosperity of the city, has not been lowed to pass without leaving an indelible mark on the history sanitary science in Germany, for it has furnished a stimulus fresh exertions being made all over the country to guard, if ssible, against such dire disasters in the future, and the use unfiltered surface water is now absolutely prohibited by the erman Imperial Board of Health.

In connection with the influence of frost on the efficiency of sand-filtration, I may mention, that in the monthly bacteriological examinations which I formerly made of the London waters for the Local Government Board, I repeatedly showed that it is during the winter months that the largest number of bacteria appear both in the unfiltered and filtered waters of the Thames and Lee. In the diagram page 573, I have brought together the monthly average results of my bacterial examinations of the filtered Thames water supplied by the London Companies during three successive years, and in the same diagram I have recorded the temperature of the unfiltered Thames water during the same period. This diagram brings out in a most striking manner the connection between temperature and the bacterial quality of the filtered water. It will be seen that it is precisely on those occasions when the temperature of the river is in close proximity to the freezing-point, that the bacteria in the filtered water become exceptionally numerous.

It is obvious, therefore, that this connection between frost and sand filtration is a matter of the very highest importance in connection with the safety of towns supplied with filtered surface water, and one which has hitherto received insufficient attention.

As bearing upon this question of the interference with the normal efficiency of sand filters and the outbreaks of zymotic disease, I may mention that Mr. Shirley Murphy, the Medical Officer of the London County Council, has recently drawn up a report in which he points out that on the 49th, 50th, and 51st weeks of the year 1894, there was an exceptional outbreak of typhoid fever in London which was not confined to any one particular district, but was distributed over a very wide area supplied by the rivers Thames and Lee. The Medical Officer goes on further to state that a "very exceptional flood occurred "in these rivers [Thames and Lee] at a time which corresponds "with that at which some new factor in the causation of "enteric fever might be expected to have come into operation. "These circumstances, I submit, indicate the need for watch-"fulness over the distribution of enteric fever in London in its "relation to water-supply."

Whilst, therefore, there can be no doubt of the great value of sand filtration in protecting the water consumer from water-borne disease, when this filtration is carried on under such favourable conditions, and under such proper control, as to continuously secure the high efficiency of which it is capable, I feel it to be my duty to call attention to the practice which is arising in some quarters of booming and testimonialising water supplies simply on the strength of their being sand filtered, and quite irrespectively of the results yielded on bacteriological examination. For I need only refer to the instances cited in my book on "Micro-organisms in Water" to demonstrate that it is not sufficient, as some would lead the public to believe, to rush a polluted surface water through a few inches of filter-bed, however clumsily constructed, in order to obtain without further trouble or expense a filtrate which is as safe as the water derived from the profoundest bore-hole or the most deep-seated spring.

In conclusion I would add, that whilst the services of water bacteriology to sanitary science have been of the very highest value, much still remains to be done in obtaining public and official recognition in our country for this now well established method of enquiry. We have only to glance at the regulations issued by the German Government in respect of the filtration of surface water, regulations which have been based and built up on the evidence furnished by bacteriological investigations, we have only to glance at these regulations in order to realise how far behind we still are, in officially recognising the important services which water bacteriology can render to the community.

Mr. **Stenhouse** said that he should like to ask one question. The author, in his very able paper, and especially in his reference to the diagram, gave the number of microbes in the filtered water, but nothing whatever was said about the number of microbes in the unfiltered water. He would like to ask if, when the microbes were very high in contrast, there was a corresponding increase of numbers in the unfiltered water? In the summer and winter months there were different conditions, which might have an effect on the number of bacteria in unfiltered water.

Mr. C. H. **Cooper** (Wimbledon) said, with regard to the aeration of filters, that it was rather remarkable that in the London waterworks the filters—as he understood—were worked continuously, and were not given rest for aeration, yet there was this very large diminution in the number of bacteria. In the case of sewage filters, and in the case of the filters that had been experimented upon by the Massachusetts State Board, it had been found absolutely necessary to give the filters rest for aeration. No doubt Dr. Frankland would explain the principles that governed the filtration in each case. There was also the question of covering filters. He believed it was a fact that in order to get the maximum efficiency out of a filter it must be exposed to the sun. In winter there was very little sunlight, and he supposed it was a matter of temperature then that must be relied upon. In America the Massachusetts people had covered their sewage filters with calico or cloth at a small height above the ground. This was sufficient to prevent the filters being frozen. He understood from the paper that the covered filters Dr. Frankland alluded to were built in, and it would be rather interesting to know if these filters gave in the summer as good a result as filters which were exposed to the action of the sun's rays.

Dr. H. R. Kenwood (London) said he should very much like to know if Dr. Frankland had any explanation to offer of this fact. He told them that in the coldest months of the year the bacteria were numerically greater in the unfiltered water than in the summer months. He also told them that the bacteria were numerically greater in the filtered water in the cold months than they were in the warmer months. Now he knew that Dr. Frankland shared the general belief that the great action of the sand filter in the removal of bacteria, and in the general purification of water, was due to the film which formed in the upper quarter of an inch of the sand, and which itself consisted largely of micro-organisms. Arguing, therefore, from Dr. Frankland's observation, that bacteria were chiefly in evidence in the coldest months, that film should be more efficient then than in the warmer months. How, then, did he explain the fact that the filter was less efficient? The micro-organisms in the film were protected from the frost in the winter by at least a foot or two of water, so that the active part of the filter could scarcely be interfered with by ice. They would like to know therefore how to account for the bacteria being greater in the filtered water during the excessively cold months. There was one other point which occurred to him as he listened to Dr. Frankland's very excellent paper, and that was, that reference had been made to one or two epidemics of typhoid fever in the winter months during the last five years, and it was suggested that these epidemics of typhoid fever were due to the breaking down of sand filtration. Well, he would remind Dr. Frankland that they had had during the past five years a greater number of epidemics of typhoid fever, and a much greater number of typhoid fever cases in the warmer months, and therefore he considered they could not conclude that the epidemics in the winter months were due to the breaking down of the sand filtration owing to the frost, unless they had evidence of the most positive nature bearing upon the point. The outbreaks referred to by Dr. Frankland had occurred upon the Continent, where the water filtration was not, he believed, particularly good at any time. He should like to know whether Dr. Frankland was satisfied that the evidence upon which the basis of his conclusions was arrived at was entirely convincing or not.

Mr. Watson (Aberdeen) said he should like to ask Dr. Frankland whether he understood him aright when he said that in Germany the local authorities now insisted on the filtration of all water supplied to towns. He should like to ask whether spring water, as differing from upland surface water impounded in the ordinary way, was also included in that order?

Dr. PERCY FRANKLAND (Birmingham) said, with regard to the question which Mr. Stenhouse put as to the number of bacteria in the unfiltered water, he thought he would find, if he referred to his paper, that it was there stated generally that he found the number of bacteria in the unfiltered water to become much increased during the winter months. So that in the winter months there was a large number of bacteria in the unfiltered water, and in times of frost also a large number of bacteria in the filtered water; whilst there are many occasions during the winter months when we had a large number of bacteria in the unfiltered and only a small number of bacteria in the filtered, consequent upon the high efficiency of the filtration unless interfered with by frost. Then there were some questions addressed to him by Mr. Cooper, who seemed to think it remarkable that this high efficiency of filtration could be secured with continuous filtration; and who referred to the filtration of sewage which could only be accomplished satisfactorily by intermittent filtration. But the filtration of sewage and the filtration of potable water were not absolutely identical, though there could not be any doubt that the object of the engineer is in a sense the same in the two cases, viz., to purify. Still, in the filtration of potable water, the water engineer cannot expect to improve much upon the chemical quality, as was shown by the analysis printed in the paper. The effect of filtration upon the chemical quality of potable water was very slight, and for present purposes it could be neglected altogether. In the filtration of sewage we had to remove putrescent organic matters. We were not in the first place obliged to consider the removal of bacteria from it, and unless, indeed, the sewage effluent was to be discharged into a stream which was subsequently used for drinking-water, he did not suppose that there was any great object in removing the bacteria in the treatment of sewage. For chemical purification during filtration, it was absolutely necessary that there should be intermittent filtration, so as to enable the process of oxidation by the nitrifying organisms to take place. On the other hand, for the filtration of potable water for drinking purposes, mechanical filtration was sufficient, and there was no necessity that such filtration should be intermittent. The whole object of such mechanical filtration was to remove the bacteria and other suspended matters in the water. Mr. Cooper referred to the use of intermittent filtration for potable water by the Massachusetts Board at the Lawrence experiment station. It was true that the effect of intermittent filtration for potable water had been tried there, and it was rather a remarkable thing that very good results had been obtained. But the results were no better than with the continuous filtration, and it was to his mind rather surprising that they were so good. We should imagine that if a filter be allowed to run dry, the structure of it would be so impaired that it could not be so efficient as a mechanical strainer afterwards. It appeared from these Massachusetts experiments, however, that the intermittent filters could also, for purposes of water-works filtration, yield good results. But he had shown that the results were no better than those obtained by the continuous system: and the use of intermittent filters means an enormously larger filtering area. If filters are allowed to run dry, there must be at least double the filtering space. Then, with regard to the covered filters. He did not wish to imply that there was any advantage in having covered filters in places where there was no danger of frost interference in winter months. What had been suggested by Mr. Hazen, of the United States, was that it was only in those places where there was a mean January temperature below the freezing point that there was any necessity for adopting these covered filters. As regarded the efficiency of covered filters, they were, if properly constructed, quite as efficient as open filters. The effect of sunshine upon filtration was probably only very trifling. The water was only on the filter for such a short time, that the destruction of bacteria by insolation was probably insignificant. Besides, the water was often too turbid for the sun to penetrate it. There was one very distinct disadvantage in exposing filters to the sunshine, and that was, that thereby the growth of green plants was promoted which sometimes rapidly choke up the whole apparatus. So that in these covered filters the length of life of the filter was greater, for there were none of these algal growths choking it up. In that way a larger quantity of water could be got through the filter at the same rate. There was one disadvantage about the covered filters, but this was only a difficulty connected with their construction. These covered filters are roofed over with masonry which requires pillars for its support. Every one of these pillars was a source of danger, for it was just at the points of contact between the pillars and the layer of sand that have unfiltered water was liable to pass through. So that in the case of covered filters one was really introducing a number of dangers in this way. If those pillars were properly constructed, and had ledges placed at different distances beneath the sand level, so as to increase the surface of contact, then it was possible for just as effective filtration to take place there, as in other parts of the structure. Then with regard to Dr. Kenwood's comments on his paper. He thought that what he had already said indicated that he did not personally attach any great importance to the nitrification going on in the filter bed, for the reason that there was no appreciable nitrification going on in such continuous filters. The water, after filtration in the ordinary waterworks filter, did not contain practically any more nitrates than it did before. Dr. Kenwood asked for the reason of the inefficiency of the sand filters in the winter. That of course was a very important question, and he was glad that it had arisen, as he would like to offer one or two words of explanation in respect to it. There could be no doubt that these filters do become inefficient when the temperature was below freezing point. Probably what took place was this: the surface of the unfiltered water standing in the filter became frozen, and it was then generally broken away at the sides so as to prevent its completely covering the filtering tank. The broken fragments of ice were heaped upon the surface of the ice in the middle. That ice became heavier and heavier, and sank down, and in some cases the points of the ice below may come into frictional contact with the surface of the sand and destroy the slime layer on the sand, which was the most efficient part of the filter bed. Then, again, in many cases these filters had to be cleaned during the winter months. The water was run off, and the surface of sand for about an inch had to be scraped away. Now during this process, in the case of a sharp frost, the upper surface of the sand freezes and cracks, and irregularities in the sand make their appearance; so that afterwards, when the water was turned on again, unfiltered water found its way down the cracks, and thus very serious inefficiency of filtration resulted. He believed that was the chief cause of the inefficiency of filtration during the frost. The bed during the cleaning process underwent freezing, and the important slime layer, which was the mechanical filter, was injured. Then with regard to the typhoid mortalities in winter and in autumn. He did not for a moment wish to imply that all typhoid epidemics were due to water. He thought one thing we had become fully aware of was that typhoid was borne in other ways than by water; but that it may be borne by water he thought was undoubtedly proved also. Now the normal course of typhoid was that it increased somewhat in the autumn. Whether this increase was due to water or not, he was not prepared to say. He did not believe that there was any increase of the kind in the Metropolis which could be traced to water; at least, he was not prepared to say that it could be so traced. But there were instances which he had referred to—more especially those which had occurred upon the Continent—which, in the opinion of competent observers, had been traced to these irregularities in the filtration of water during those frosty periods. There were outbursts of typhoid at a time when outbursts were not normally expected to take place, and when the other causes were not so much in operation. And concurrently with these increases in typhoid, we had these interferences with the efficiency of filtration. It must be remembered that the stream or river waters which were filtered for the purposes of consumption at Berlin, Altona, and Hamburgh were of much worse quality than the Thames and Lee. With water of such bad quality, when the efficiency of the filtration became impaired, we should of course have much greater probability of this inefficiency being reflected in the typhoid mortality or in the typhoid case rate. Well, lastly, with regard to Mr. Watson's inquiry. These German orders regarding the filtration of water referred only to surface water. According to the orders of the Imperial German Board of Health, all surface waters supplied for drinking purposes had first to be filtered. In conclusion, he thanked them for the kind way in which they had received his paper, and for the manner in which they had criticised it.

"*Village Water Supplies*," *by* JOHN C. THRESH, M.D., DSc., &c., Medical Officer of Health, Essex County Council.

(MEMBER.)

DURING the last half century so much attention has been given to the provision of public supplies of potable water, that nearly every town in the United Kingdom has obtained such a supply of a more or less satisfactory character; but our rural districts and the great majority of our villages still derive water from more or less objectionable sources, and the supplies besides being liable to contamination are often very deficient in quantity and not readily available. The result is that personal cleanliness is too frequently neglected, and the houses and surroundings are generally uncleanly. Medical officers of health in charge of rural districts are continually complaining of these insufficient supplies, and almost daily recording outbreaks, or extensions, of disease attributable, directly or indirectly, to the lack of an abundant supply of wholesome water.

The local authorities are authorized by parliament to carry out all works necessary for providing sufficient water, and one of the express duties charged upon them by the Public Health (Water) Act, 1878, is that of seeing that every house has within a reasonable distance an available supply of wholesome water, sufficient for all domestic requirements. This duty has been greatly neglected, because public supplies of water cannot be obtained without expense, and too many members of local authorities regard the keeping down of the rates as being their chief duty, if not the one and only duty which they owe to the ratepayers who elect them. These gentlemen have no conception of the advantages of a public supply of pure water, and have exaggerated ideas with reference to the difficulties and expense of obtaining it. Engineers and hydrologists, busy with large schemes, have not given this subject the attention it deserves, and I know that the dread of incurring heavy initial expenses in consulting experts has prevented many works of village supply being executed.

I am decidedly of opinion that every village, however small, should have a public supply, for the abundance and purity of which the Local Authority should be responsible. If a scheme for conveying the water by mains to the houses is for any reason not feasible, public wells may be sunk in the most convenient situations, or springs may be properly protected and rendered easily available. In probably a great majority of villages, however, a public supply of wholesome water could be obtained and conducted by mains to most of the houses at a cost comparatively reasonable.

The amount of water required for village supplies is much less per head than in towns, especially when the water is drawn from stand pipes only and not laid on to the houses. Moreover little or no water is required for municipal purposes (sewer flushing, &c.), hence a supply of 10 to 15 gallons per head per diem is, in very many cases, much more than will be used. The more urban in character the village the larger the supply required, but with well laid mains, twenty gallons per head per diem ought in every case to be abundant. The approximate amount required being known, some source capable of yielding this as a minimum has to be discovered. We may resort to springs, to the subsoil, or we may penetrate more deeply into the earth with the view of tapping a subterranean source of water. If there be a sufficiently large stream of unpolluted water, it may be possible to derive a supply therefrom, provided the amount of water abstracted does not affect the riparian owners, or the rights of others lower down the stream. So few streams, however, are safe from pollution, that it is always better, if possible, to go to the fountain head and tap the springs—the feeders of the stream. There are large numbers of springs throughout the country waiting to be utilized. Where a spring rises at a sufficient elevation to supply the village by gravitation, and is within a reasonable distance, it is gerearally the most economical source. If the spring is of sufficient volume, yet too low to supply the district by gravitation, probably an inexpensive hydraulic ram, turbine, or water wheel can be used. This, without any expenditure for labour or supervision, may throw a sufficient quantity of water to a tank at an adequate elevation, from which the village may be supplied.

Some six years ago, a spring of this character, rising in a parish in one of my districts, was utilized for supplying the village. The village was on the top of a hill, the spring on the side, 180 ft. below the highest point to which the water must be raised. The yield was a minimum of 50,000 gallons a day. A ram was put down and 8,000 gallons of water is daily pumped up to a reservoir in the village, and supplies a population of about 700. There are three miles of mains, and the total cost was £807. A rate of 1/- in the pound realizes within £2 annually, the whole sum necessary to pay off the principal and interest in 30 years. This 1/- rate is levied only on the users of the water, and the only burden on the general sanitary rate is the odd £2. We have however, done more than this. The spare 42,000 gallons of water which has passed through the ram is collected in a reservoir and caused to supply by gravitation considerable portions of four other thinly populated parishes. This extension cost £3,000. The mains are nearly 8 miles in length, and every house along their route has the water laid on to the premises. A rate of 1/6 in the pound nearly raises the whole sum required to pay off the principal and interest in 30 years.

On account of the disrepute into which shallow wells have fallen, on account of their faulty construction and general insanitary surroundings, the subsoil as a source of water supply is being neglected. Yet in very many localities there are immense stores of water in the subsoil which can be utilized. If a proper site be selected, and proper precautions be taken very pure water can be obtained from this source. It will almost invariably require pumping, but this may be cheaply effected by aid of a windmill, a hot-air engine, or by an oil or gas engine. I could give several examples of such village supplies. Within the last few weeks I have been engaged finding a supply of water for a village of about 1,000 inhabitants. A very eminent engineer who had been consulted reported that the only hope of obtaining a supply of water was by sinking a deep well, and he estimated the cost at £6,000, but as he expressed a doubt as to whether sufficient water was obtainable from such a well, he did not recommend the parish to carry out the scheme. I found that there was, close by, a large area of sand and gravel covered with brick earth, the whole being about 19 ft. thick, and containing 9 feet of water. The experiments which I have had carried out, prove that 30,000 gallons of water per day can easily be obtained within a quarter-of-a-mile of the village, and I estimate that the total cost of supplying the parish therefrom will be under £2,000. In a parish in one of my districts, having a population of 2,500, the water is pumped from a similar source, and a 1/- rate, levied on the consumers only, defrays the whole annual expense. Other examples of villages supplied in various ways—simple gravitation works, spring water raised by rams, turbines, and water-wheels, and by pumping with steam, oil, and gas engines, subsoil water supplied by gravitation, and by pumping, etc., will be found in my little work on water and water supplies.

Where water mains are laid in rural districts, building operations are encouraged, since the builders are no longer under the necessity to sink wells, construct rain-water tanks, fix pumps, &c., with their initial expense, and constant trouble to keep in repair. Frequently the interest on this expenditure exceeds that of the water rate which would have to be levied to pay for a public supply. Houses also which have the water laid on always let more readily than those dependent upon wells or other such sources of supply.

The money required to carry out a village water supply may, with the consent of the Local Government Board, be borrowed and be repaid by thirty annual instalments of principal and interest. The annual cost therefore will be this instalment, plus any expenditure entailed by pumping and in keeping the works in repair. There is no uniform procedure for raising this annual sum. In certain districts the whole is levied upon the houses supplied with water, in others a charge is made on the general sanitary rate for the water used for flushing sewers, road watering, &c., whilst in others the special water rate only covers cost of maintenance and pumping (if any), the cost of the works being borne by the whole parish. This would seem to be the fairest way, since the works ultimately become the property of the whole parish, and not merely of those who use the water. In many districts, landowners and property owners who would be specially benefited by a public supply have contributed liberally towards the expense, thus lightening the burden upon the parish, and the "Limited Owners Reservoirs and Water Supply Further Facilities Act, 1877," enables a landowner to charge his estate with the cost of constructing works for the supply of water thereto, or he may enter into an agreement with the local authority for a supply of water, the cost being an improvement charge upon the estate.

The difficulties in the way of supplying villages and rural districts have been greatly overrated, and probably but in few cases are they insurmountable. In recommending a really good scheme, one can always feel the utmost confidence in asserting that, however much it may be opposed by those intended to be benefited—and local opposition always arises when a sanitary authority proposes to provide waterworks—the works will not have been in existence long, before the benefit will be gratefully acknowledged.

Mr. G. J. Symons (London) said he did not want to take up the time of the Section in the absence of Dr. Thresh, who had devoted a great deal of time to the subject. There was, however, one remark upon the paper which might possibly bear fruit; Dr. Thresh pointed out the difficulties which many of these smaller districts feel in consulting eminent experts who up to the present time had had the question of water supply very much in their own hands. Of course, Dr. Thresh was a medical man, and it was for him to point out the advisability of getting a good supply of water. It was the province of the surveyor or engineer, rather than of the medical man, to arrange the process by which it could be worked. He ventured to think that if some young engineer would throw himself into the breach he would find that a multitude of small undertakings would be quite as profitable as one big one.

Mr. J. E. **Parker** (Lanchester) said with reference to the remark made by the Author of the paper that "moreover little or no water was required for municipal purposes (sewer flushing, &c.), hence the supply of ten to fifteen gallons per head per diem was in very many cases much more than would be used." He could confirm this from his own experience. In the rural district where he worked the water supply as registered by meter had only been 6·7 gallons per head of population per day.

Mr. **Watson** (Aberdeen) said that he thought they were indebted to the reader of the paper for the excellent remarks made with regard to the difficulties of supplying villages with water. The Author referred to one point which he would like to emphasize, and it was a point which he thought they all ought to do their best to amend. It was this, that the cost of providing water for villages, in comparison with the amount of assessible rental, was very great, and an ordinary water scheme for a village very often brought up the cost to a rate of something like 1s., and he knew of one or two cases where it had reached 2s. in the pound. One reason for that was the high rate of interest which local authorities had to pay to the Government for borrowed money. At the present time money could not be borrowed for less than 3½ per cent. per annum. He thought that was excessive, because we were all aware that the Government could borrow money for 2¾ per cent. Now taking the ordinary local authority the security was thoroughly good, and he did not see why the Government should not stretch a point in this respect. They should also extend the period for repayment to forty instead of thirty years as at present. There was one arrangement in Scotland which he was not sure they had in England. It was this: that each village must provide its own water scheme under a bond for repayment and for which the villagers benefited have to become responsible to the lender. Now where one is borrowing only £500 or £1,000 it is impossible to borrow from a private Lender on the Annuity System at a low rate of interest. If the county could borrow so much money for all the County Water Works, just as a city or town does when it borrows money for a particular scheme in a suburb, it would be a much simpler matter.

Mr. **Berkley** said that in many villages, they had no water supply except the wells. When the neighbourhood increased, railways came near them, and houses had been built, the residents began to think they would like a supply of water. Some were willing to subscribe to a water supply, and some thought that when there was a water supply it would mean a further expense, because they would not only have to supply the water, but to get rid of it afterwards, and that would involve a drainage system. What they wanted was to have the thing laid out thoroughly before them, and know what it would lead to.

"*Ownership of Underground Water,*" *by* C. H. COOPER, Assoc.M.Inst.C.E.

(MEMBER.)

THIS short paper is intended to record the fact that a water company has, within the last few years, appropriated the water that supplied a population of about 7,000 persons and various factories, in many of which cases the supplies had been in use for more than forty years.

The same company continues to make other borings which, when completed, and furnished with pumping machinery, will lower the water line so as to dry up the few remaining artesian wells, and in the author's opinion will reduce the yield of the springs that supply the River Wandle.

This appropriation of water supplies has to be submitted to, on account of the law relating to underground water which does not recognise any ownership or right of usage of such water.

The case of Chasemore *v.* Richards, tried in 1859, 7 H.L. Cas. 349 is a standard case where "a landowner and a miller who had for above sixty years enjoyed the use of a stream which was chiefly supplied by such percolating underground water, lost the use of the stream after an adjoining owner had dug, on his own ground, an extensive well for the purpose of supplying water to the inhabitants of the district, many of whom had no title as landowners to the use of the water; it was held that the mill owner had no right of action."

In Acton *v.* Blundell, tried in 1844, 12 M. & W. 334, it was held that "The owner of land through which water flows in a subterraneous course has no right of interest in it which will enable him to maintain an action against a landowner, who in carrying on mining operations in his own land in the usual manner drains away the water from the land of the first-mentioned owner and lays his well dry."

Lord Chancellor Hatherley in the case of the Grand Junction Canal Company *v.* Shugar, tried 1880 and 1881, L. R. 6 ch. app. 483 observed: "I do not think Chasemore *v.* Richards or any other case has decided more than this, that you have a right to all the water you can draw from the different sources which may percolate underground; but that has no bearing at all on what you can do with regard to water which is in a defined channel and which you are not to touch. If you cannot get at the underground water without touching the water in a defined channel I think you cannot touch it at all."

In legal decisions there is far too great a tendency to base such decisions on those already decided, although when the former cases were tried the knowledge of the matters in question was very scant compared to that now obtained.

The methods at hand at present of obtaining information and the improvements that are being made from year to year would, it might be supposed, lead Courts of Justice to found their decisions on the principles that govern matters in question rather than on bygone decisions made when such principles were not known.

The author would regret to see any undue restrictions placed on the acqusition of underground water, but legislation should prevent the rights of others being damaged.

The Company alluded to is the Southwark & Vauxhall Water Company, who in 1887 sunk a well at Streatham to a depth of 1,120 feet which passes through 35 feet in thickness of Thanet Sands 206 feet below the surface, 623 feet of chalk and 29 feet of Upper Greensand.

Whilst the boring for this well was taking place the level to which the water rose in many of the Wimbledon wells was so reduced that about 100 houses lost their supply, and had to be connected with the Lambeth Company's mains.

After operations at the Streatham well ceased, about 1888, the water level of the Wimbledon wells rose nearly to its former level, till continuous pumping at the rate of one and a half to two million gallons a day was commenced in July, 1895, when the level fell considerably, and continued to fall till about June of 1896.

The greatest depression caused by pumping at Streatham is fifty feet, while the amount that the water line has been lowered at the "Willows," Summerstown and at the Wimbledon Sewage Works may be taken at about fifteen feet. Table "A" gives the lowering of the water line in several wells.

This lowering of the water line has been the means of doing away with the Artesian Wells in Wimbledon, Merton, Tooting, Mitcham, and Wandsworth, except in a few cases.

The population formerly supplied by these wells was about 7,000, in addition to which several factories derived their supply from the same source, and many acres of water-cress beds had the advantage of water at a temperature of 52° F. all the year round.

The loss of the water supplied from these Artesian Wells involves serious sanitary and financial considerations.

From a sanitary point of view the water was free from organic pollution, whereas the water which has been substituted is derived from the Thames—a source generally condemned on account of contamination by human excrement.

The owners of property or their predecessors had to bear the expense of sinking wells, the supply of which has now been appropriated; the cost of keeping the fittings in repair was very small. On the other hand the cost of having water laid on from the Company's mains with special pipes and fittings and the payment of the water rate is a matter that presses heavily on the labourers and factory hands who occupy most of the houses affected, and whose rents have been generally raised about 1s. per week in consequence.

The financial question unfortunately does not rest here, for it should not be lost sight of that before long the London Water Companies will have to be purchased, in which event the companies will have to be compensated for an annual rate that cannot be short of £1,300 a year.

There are other considerations that must not be lost sight of —the water from the artesian wells was invaluable for boilers as no crust was formed. The temperature at which the water rose, about 52° F., enabled water-cress growers to get earlier crops than they could otherwise have had.

That the number of wells sunk from time to time has reduced the level to which the water rises there is no doubt, but the effect of borings for small supplies does not produce the destruction of wells that the pumping at Streatham has brought about.

The borings already alluded to as now being made by the Southwark & Vauxhall Water Company are situated at Mitcham, close to Merton Abbey Station, and at Raynes Park. When pumping operations are in full swing at these wells and at Streatham there is no doubt that the depressions in the water level caused will considerably reduce the yield of the Wandle Springs at Carshalton, Beddington, and Croydon.

When it is considered that there are no less than twenty mills either wholly or partially dependent on the Wandle for their power the effect of the Southwark & Vauxhall Water Company's boring should be carefully gone into by those interested.

The author has to thank Mr. Dodd, Surveyor of Wandsworth, Mr. Marten, Surveyor of Streatham and Tooting, and specially Mr. Chart, Consulting Surveyor of the Croydon Rural District Council, for the information they have supplied respecting the populations formerly supplied in their respective districts from artesian wells.

TABLE A.

Information re *Wells.*

Position of Well.	Date when sunk.	Depth below surface, in feet.	Height of surface above Ordnance datum.	Stratum to which bore was carried.	Height above O.D. to which water rose when boring was made.	Yield in Galls. per minute when boring was made.	Height above O.D. to which water now rises.	Present yield in Galls. per minute.	No. of Houses supplied previous to 1896.	
Summerstown, Wandsworth ...	...	195	31	Thanet Sands	...	...	32	...	60	In 1876 the water rose 41 above O.D. In June, '96, the water practically ceased running, and the well was abandoned.
St. Clement Danes Almshouses, Streatham	...	155	42	Do.	57*	...	...	...	...	* Height of Cistern. Formerly filled from Well. In 1876 water rose to 50 O.D.
Tooting Church	1822	130	58	Do.	65	130	...	...	...	In 1876 the water rose to 60 at O.D., and yielded 13 gallons per minute.
Wimbledon Sewage Works	1876	400	52	Chalk	51·75	...	...	...	...	
Chuter's Skin Factory, formerly Copper Works, Wimbledon	...	143	35	Thanet Sands	55	120	...	2·5	...	In 1876 the water rose to 55 at O.D.
The Willows, Wimbledon	...	235	38	...	...	...	35	...	...	
Southwark & Vauxhall Water Company's Well, Streatham	1887	...	110	...	...	...	...	...	...	
Crystal Palace Well	1852	600	190	Chalk	100	41	...	...	...	

Mr. William Logan said he thought the paper was an interesting one from the author's point of view. It may be very interesting to Streatham, but if the Author had had as much knowledge of the ownership of the underground water as they had in the North of England he would know that they threshed this matter out very many years ago. He thought the law had always been very clear and explicit upon the question that every person had the right of ownership of all underground supply of water existing underneath his own ground, and that any person may sink a well, and sinking it deeper take his neighbour's water without being subject to any liability in the matter at all. It was only a question of degree whether one sinks a well 100 feet, or whether his neighbour sinks one 1,200 feet deep. If he went to the expense of sinking one 1,200 feet deep, he had the right of doing so. Now in the counties of Durham and Northumberland we all know that mining operations take principally all the surface water away, and yet the owners are not liable so long as they do not destroy a stream, for no one has any right or ownership in the underground water, because no man knoweth whence it cometh, or whither it goeth. In Durham we have the large towns of South Shields, Sunderland, Hartlepool, and the whole East Coast of Durham between the Tyne and the North of the Tees supplied by wells conveying underground water to the surface. If the owners of the land at these particular points had said,—"You are not to sink your well becanse you take a supply of water underground which may possibly belong to me," then all these large towns with their hundreds of thousands of population would have been without water supply to-day.

Earl Percy said he rather agreed with the gentleman who had just sat down. He had stated the law correctly, but he should like to know the remedy. Many people had suffered by having a mine flooded by something his neighbour had done next door, or by the reverse, viz., by water being taken away. At the present moment the town of Morpeth was—largely owing to coal workings—very hard up for water. What was the remedy? How could any expert tell with absolute certainty what would be the consequences of sinking or pumping in any particular place? They may sometimes be able to tell, but very often they cannot, and we should be landed in a most terrible amount of litigation and doubt if we attempted to prove that want of water was caused by any particular operation. He did not see how the difficulty was to be met except in one way, and he believed it was the way in which it was met to a great extent in the case of a water company. The water companies have generally to go to Parliament for powers, and where Parliament sees any strong reasons for anticipating that any operations of the water company would affect the water in the surrounding district, it would sometimes put certain obligations upon the company—such as that they should supply that district at a reduced cost, or something of that sort to meet the difficulties of the locality. That was the only way in which it seemed to him the difficulty could be met. When a water company goes to Parliament, it was for the inhabitants of the district to look for those things for themselves, and insist if possible that such clauses should be put in.

Mr. C. H. Cooper (Wimbledon), in reply, said it certainly seemed rather peculiar that if a person could hold property at all, he could not hold that of a supply of water. It was absolutely necessary for health and other purposes to have water. He thought Mr. Logan's remark that "no man knoweth whence underground water cometh or whither it goeth" might have been all right at the time of the Scriptures, as regarded the knowledge of the subject, which was then rather meagre; but it certainly was not right now, either as regards the air they breathe, nor was it right as regards underground water. The direction of flow of water through the chalk and Thanet sands of the London Basin had been determined; we therefore know whence it cometh and whither it goeth. Lord Percy had referred to the water supply of a town that had been affected by coal mining operations. Can one imagine anything worse than that some private owner, because he happens to have coal under his ground, has the right to deprive a town of its water supply in order to work his coal. If the coal was worth winning for the landowner, surely he ought to compensate those whom he deprives of water, that they may have had an undisputed right to. But as the law stands such a landowner had got the perfect right to deprive a town of its water, although the acquiring of a fresh supply may cost three or four times as much as the coal procured may be worth. He did not think for one moment that the law was right as it stood. Supposing it was possible for one man, because he made a longer pocket in his coat, to deprive his neighbour of the money that was in his, would that be right? But it was perfectly legal for a man to sink a deeper well to deprive his neighbour of his water.]

Earl Percy said he should like to point out that he did not say that any particular landowner or colliery proprietor had taken away the supply from any town with which he was acquainted. What he said was that coal workings had done it, or were supposed to have done it, in a district full of coal pits, and the difficulty was to find out which of the colliery owners were responsible.

"*The effect of the Cold Weather in the Early part of 1895 on the Admission of Medical Cases into the Royal Edinburgh Infirmary. With a note on some earlier periods of Severe Weather,*" *by* A. LOCKHART GILLESPIE, M.D., F.R.C.P.E.

IN a paper read before the Royal Society of Edinburgh in 1896, I gave the results of an investigation into the influence of various weather conditions on the type of the cases admitted into the medical wards of the Royal Edinburgh Infirmary. The remarkable divergence between the meteorological conditions prevailing during the earlier weeks of 1895 and of 1896 led me to work out the differences of the admissions into these wards for the two periods. The figures for several cold periods which have occurred during recent years were also noted.

The periods under review comprise the first eleven weeks of 1895 and 1896; six weeks from December 7th, 1874, to January 17th, 1875; eleven weeks from December 2nd, 1878, to February 16th, 1879; twelve weeks from November 15th, 1880, to February 6th, 1881; five weeks from November 26th, to December 31st, 1882; and seven weeks from December 8th, 1890, to January 24th, 1891. As a standard, the means for the seven years from October 1st, 1888, to September 30th, 1895, as given in the former paper, are taken, and though it should be remembered that the means of the actual numbers are of little value owing to the increased number of admissions, the percentages of admissions of particular classes of disease to the total admissions are, of course, directly comparable.

Noticing first the eleven weeks which began the years 1895, 1896, we find that the mean temperature of these weeks in the east of Scotland district of the Meteorological Council, was only 30°·9 in 1895, 39°·9 in 1896. The highest shade temperature recorded were almost identical, 58° and 57°, but the minimum in 1895 fell as low as − 17°, against 18° in 1896. The mean of the weekly maxima in 1895 was 45°·4, the minima 7°·5, in 1896 53°·6 and 24°·1 respectively. The total excess of the temperature mean in 1896, compared with 1895, for the eleven weeks reached the large figures of about 99°. The rainfall was almost the same for both periods, 4·70 in. and 4·24 in.; the percentage of possible sunshine was also very similar, 22·5 per cent. and 24·0 per cent., while during both the barometric type was identical, six weeks anti-cyclonic and five weeks cyclonic.

On turning to the admissions into the Infirmary (see Table I.) we find that the total admissions into the medical wards averaged 93·6 per week in 1895, 84·5 per week in 1896, or a decrease of

TABLE I.

Showing the differences between the Admissions during the First Eleven Weeks of 1895 *and* 1896.

YEAR.	Thermometer.			Rain.	°/o of Possible Sun.	Type.	Total Admissions.	Deaths.	Pneumonia.	Pleurisy.	Total Respiratory.	Cardiac.	Nervous.	Rheumatism.	Digestive.	Kidney.
	High'st.	Lowest.	Mean.													
				IN.	HRS.											
1895	58	-17	30·9	4·7	22·5	A 6 C 5	1031	99	47	26	238	83	122	39	151	35
1896	57	18	39·9	4·24	24·0	A 6 C 5	930	74	31	28	197	108	146	37	136	75
Weekly Numbers.																
1895	45·4	7·5	30·9	·43	22·5	......	93·6	9	4·2	2·3	21·6	7·5	11·1	3·5	13·6	3·2
1896	53·6	24·1	39·9	·38	24·0	......	84·5	6·7	2·8	2·5	18·0	9·8	13·2	3·3	12·3	6·8
Percentages to Total Admissions.																
1895	...	...	...	...	...	......	......	9·6	4·5	2.5	23·08	8·05	11·8	3·77	14·5	3·39
1896	...	...	...	...	...	......	.. ...	7·9	3·3	3·01	21·1	11.6	15·7	3·9	14·5	8·06
The Five Coldest Weeks of 1895. *Percentages to Total Admissions.*																
1825	40·4	-4·8	26·0	·28	28·2	......	91·4	9·6	3·9	3·2	24·9	7·4	12·0	3·4	14·8	2·56

nearly 9 per cent. Disregarding the actual admissions, the percentage of admissions of separate diseases or classes of disease to the total admissions of all kinds, are instructive. The rate of mortality is much higher, the proportion of patients admitted with pneumonia, and with respiratory disorders as a whole, is increased in 1895, the proportion of other cases is lower than in the corresponding period of 1896. This is most marked in the case of kidney disease, and reaches 50 per cent. Cases both of heart disease and of nervous affections are more numerous in the warmer year. The digestive cases are the same in both years.

Five of the first eleven weeks of 1895 were very cold, the 2nd and the 5th to the 8th. The mean temperature was 26°·0, the mean of the maxima 40°·4, of the minima 4°·8. Four of these weeks were anti-cyclonic. During these five weeks the total admissions were rather less than in the other six, while the percentage of admissions to the total were little changed, except that the respiratory cases were more in number.

Of the six weeks which were rather warmer, three preceded and three followed the period of greatest cold in 1895.

The three weeks following had a mean temperature of 36°·8, a large total admission, 105 per week, a high death-rate, 11·3 per cent.; a very large proportion of cases of acute pneumonia, 7·3 per cent., and of total respiratory cases 28 per cent. Cases of acute rheumatism were very common, 3·4 per cent.

I have drawn up a short table (Table II.) showing the relationship between the cyclonic and anti-cyclonic periods in the eleven first weeks of the two years. In 1895 the greatest cold accompanied anti-cyclonic weather, in 1896 cyclonic weather.

The cold dry weather in 1895 was marked by a greater death-rate than the warm dry weather of 1896, but the respiratory cases were much the same in number in both. A great excess of heart cases were admitted during the six dry weeks of

TABLE II.

The first Eleven Weeks of 1895 and 1896 arranged as to Barometric Type, in Weekly Means.

CYCLONIC.

	Year.	Temperature.	Rain.	Total Admissions.	Deaths.	Pneumonia.	Pleurisy.
Cyclonic, **5 weeks.**	1895	32·1°	·60 in.	93	7·0	4·6	2·2
	1896	38·7°	·56 in.	84·6	6·0	2·4	2·4

	Year.	Total Respiratory.	Cardiac.	Nervous.	Acute Rheumatism.	Digestive.	Kidney.
Cyclonic, **5 weeks, *con.***	1895	22·2	8·8	11·6	3·6	12·8	3·2
	1896	16·4	10·0	13·8	2·6	12·4	8·0

ANTI-CYCLONIC.

	Year.	Temperature.	Rain.	Total Admissions.	Deaths.	Pneumonia.	Pleurisy.
Anti-cyclonic 6 weeks.	1895	29°·9	·28 in.	94·3	10·6	4·0	2·5
	1896	40°·9	·24 in.	84·5	7·3	3·1	2·6

	Year.	Total Respiratory.	Cardiac.	Nervous.	Acute Rheumatism.	Digestive.	Kidney
Anti-cyclonic 6 weeks, *con.*	1895	21·1	6·5	10·6	3·5	14·5	3·2
	1896	19·1	9·6	12·8	4·0	12·3	5·8

1896. The wetter weeks, warmer than the dry in 1895, colder in 1896, show a great excess of cases of pneumonia in the first, and a large excess of kidney cases in the second. The total cases of respiratory disease were most numerous in the wet weather of 1895, more so than in the very cold dry weeks, the opposite holding good for 1896. The colder weeks of 1895 were accompanied with dry northerly winds and fine weather, and had less effect on the admissions than the warmer and moister weeks.

On going back as far as 1874, although there were several short spells of extremely cold weather, I can find only six pronounced periods in which the temperature remained very low for a more or less prolonged period. The periods are:

1. Dec. 7 to Jan. 17, 1874—75. Four of these six weeks were very cold.
2. Dec. 2 to Feb. 16, 1878—79. Nine of these eleven weeks were very cold.
3. Nov. 15 to Feb. 6, 1880—81. Eight of these twelve weeks were very cold.
4. Nov. 27 to Dec. 31, 1882. Two of these five weeks were very cold.
5. Dec. 8 to Jan. 28, 1890—91. Five of these seven weeks were cold.
6. Jan. 1 to Mar. 17, 1895. Five of these eleven weeks were *extremely* cold.

In Tables III. and IV. the numbers for the different classes of admissions are grouped together. The weekly mean temperature for the thirty-three very cold weeks only reached 30° Fahr. The total admissions during these thirty-three weeks were below the average, for the fifteen weeks after (which where investigated) they were above it. A glance at the figures in Table IV. will show that (taking only the percentage of admissions of individuals or diseases to the total admissions as being exactly comparable) the death-rate in the hospital rose during and after the cold periods, the number of cases of pneumonia and pleurisy, and of the total respiratory diseases rose at these periods also, those admitted with pleurisy especially. Heart cases were little affected; nervous cases still less; patients with acute rheumatism were not more numerous, nor were cases of kidney or digestive disorders. In the same Table the percentage figures for the entire seven years from 1888—1895, are given for comparison, and we may note that during the periods under review, the only classes of cases which differ materially are the cardiac, which is above, the nervous, which is below, and the acute rheumatism, which is much above the average percentage to admissions for the seven years. That is to say, that though the figures for these diseases for the periods before, during and after the cold spells, do not vary much, they differ very materially from the mean of a large number of years. Considerable stress is laid on this, as also in a former paper, or the marked influence of epidemics of influenza might be laid at the door of weather conditions. But as is shown there, influenza is a much more powerful agent in increasing the number of respiratory patients than cold weather, while cardiac and nervous cases increase in number some time after an attack rather than during it, and this quite irrespective of the weather conditions.

TABLE III—*Periods Investigated.*

No.	Year.	Number of Weeks.	Cold Weeks.	Mean Temp. of Cold Weeks.	Total Admissions.	Weekly Total.	Total during Cold Weeks.	Weekly total in cold weather.
1	1874—1875	6 (Dec. 7—Jan. 31)	4	31°·4	266	44·5	149	37·25
2	1878—1879	11 (Dec. 2—Feb. 16)	9	31·0	459	41·7	372	41·3
3	1880—1881	12 (Nov. 15—Feb. 6)	8	29·9	520	43·3	334	41·7
4	1882	5 (Nov. 27—Dec. 31)	2	28·2	250	50·0	90	45·0
5	1890—1891	7 (Dec. 8—Jan. 28)	5	33·6	518	74·0	365	72·1
6	1895	11 (Jan. 1—Mar. 17)	5	26·0	1031	93·6	457	91·4
	Totals...	52	33	30·0	3044	58·5	1767	53·5
Weeks before		4*	...	...	315	78·7	(Mean of whole periods in same years =82·7).	
Weeks after..		15	...	...	962	64·12	Do. do. = 58·2.	

* 1 in 1882; 3 in 1895.

TABLE IV.

Cold Period from 1874 *to* 1895.

PERIOD.		Total Admissions.		Deaths.	Pneumonia.	Pleurisy.	Total Respiratory.	Cardiac.	Nervous.	Acute Rheumatism.	Digestive.	Kidney.
		Actual.	Mean for Totals in same Years.									
Cold Weeks......	Weekly	53·5	58·5	7·0	2·66	1·9	12·48	5·6	6·6	2·14	6·58	2·5
(33)	Percentage to Total ...	......	......	12·5	4·9	3·5	27·0	10·4	12·3	4·0	12·2	4·6
Weeks before ...	Weekly	78·7	82·7	5·7	2·5	1·5	12·2	9·5	10·2	3·2	10·7	4·0
(4)	Percentage to Total ...	......	......	7·3	3·0	1·9	15·5	12·0	13·0	4·1	13·6	5·0
Weeks after......	Weekly	64·12	58·2	7·6	2·73	1·8	17·13	6·3	9·0	2·73	8·86	2·86
(15)	Percentage to Total ...	......	......	11·7	4·2	2·8	26·7	9·8	14·0	4·2	14·0	4·4
	Mean for Seven Years Weekly ...		75·5	7·24	3·05	2·58	15·95	6·87	12·35	2·04	10·21	3·44
	1888–1895. Percentage to Total		......	9·59	4·04	3·43	21·3	9·01	16·34	2·7	13·41	4·5

We may fairly conclude that a mean temperature which is very, or even extremely low, if it be steadily so, is not nearly so productive of evil effects as one which has a higher mean, but greater variations. That severe cold under cyclonic conditions, or even moderate cold at those times are more dangerous to health. than very extreme cold under anti-cyclonic periods, if the anti-cyclonic weather, as in 1895, be fine. While consistently warm cyclonic weather has not such a malign influence on the body as a muggy, foggy, anti-cyclone, even when the temperature is high. The anti-cyclonic weeks at the beginning of 1895 had a percentage of 27·1 of possible sunshine in the east of Scotland, the cyclonic weeks only 17 per cent. In 1896 the cyclonic weeks showed 28·2 per cent., the anti-cyclonic 20·5 per cent. The admissions of respiratory cases exactly correspond inversely to the percentage of sunshine recorded.

Year.	Cyclonic.		Anti-Cyclonic.	
	Sunshine Per cent.	Weekly Respiratory Admissions.	Sunshine Per cent.	Weekly Respiratory Admissions.
1895	17·0	22·2	27·1	21·1
1896	28·2	16·4	20·5	19·1

It is impossible to treat of the other periods mentioned in terms of weather type, as no records for the purpose exist.

A point worth mentioning, however, with regard to the admissions of patients suffering from acute rheumatism, might be added. The mean weekly admission of cases of that disease for the seven years 1888-95, when the total admissions were, of course, much more numerous, was 2·04, the percentage to total 2·7. The weekly admission for the fifty-two weeks investigated was 2·42; for the thirty-three colder weeks 2·1; the relative percentages to total admissions being 4·1 per cent. and 4·0 per cent.

TABLE III.

Showing the Weekly Differences between the Admissions into the Medical Wards during the First Eleven Weeks of 1895 *and* 1896, *with the Weekly Meteorological Conditions Added. The Admissions Entered as Percentages of Totals.*

No. of Week.	Thermometer.			Rain.	Sun-shine.	Type.	Total Ad-missions.	Deaths.	Pneu-monia.	Pleurisy.	Total Respira-tory.	Cardiac.	Nervous.	Rheuma-tism.	Digestive.	Kid-ney.
	High.	Low.	Mean.													
					%			%								
1—95	42	13	31·8	·3	13	C	61	13·1	4·9	...	18·0	4·9	13·1	4·9	14·7	4·9
96	53	26	40·9	·5	15	A	77	7·8	5·2	3·9	20·7	12·9	9·09	5·2	5·2	3·9
2—95	39	- 5	25·2	·3	22	C	104	6·7	2·8	6·7	33·6	10·5	10·5	2·8	12·5	1·9
96	53	22	37·3	·04	15	A	92	9·7	4·3	1·09	22·8	14·1	11·9	7·2	12·0	3·2
3—95	42	24	35·0	1·7	8	C	99	9·9	2·02	1·01	11·1	9·09	14·1	7·07	16·1	6·6
96	54	20	39·2	·7	28	C	96	2·08	3·1	4·16	21·8	9·3	17·9	2·08	8·32	0·9
4—95	43	19	32·0	·4	20	C	99	2·02	3·03	1·01	13·1	13·1	15·1	2·02	14·1	4·04
96	50	18	37·4	·2	33	A	71	5·6	1·4	1·4	23·9	12·6	12·6	2·8	23·9	8·4
5—95	41	1	27·5	·5	13	A	79	10·1	5·06	3·9	24·0	5·06	12·6	5·06	11·4	1·26
96	56	28	41·6	·4	27	A	80	6·2	3·7	5·0	25·0	11·2	13·7	3·7	18·7	3·7
6—95	40	- 12	24·6	·3	24	A	93	12·9	1·07	0·0	12·9	9·6	13·9	2·1	15·04	4·5
96	54	28	48·4	·2	14	A	96	5·2	5·2	3·1	19·8	8·32	15·6	2·08	17·2	9·3
7—95	43	- 17	23·1	·1	50	A	93	8·6	4·3	1·07	25·8	8·6	15·04	5·3	15·04	4·5
96	56	34	45·1	·1	19	A	91	16·4	2·19	4·4	24·1	9·89	26·3	6·5	12·1	7·6
8—95	49	9	29·8	·2	32	A	88	10·2	6·8	4·5	27·2	4·5	7·8	2·2	18·3	1·1
96	53	22	40·2	·4	16	C	76	6·5	1·3	2·6	10·5	11·8	21·0	0·0	18·4	9·2
9—95	49	19	35·4	·3	29	A	99	11·1	2·02	5·05	23·2	10·1	7·07	0·0	16·1	6·06
96	52	23	36·9	·8	39	C	84	14·2	0·0	1·19	16·6	14·2	22·6	2·37	11·9	9·5
10—95	54	18	36·3	·3	22	C	102	8·8	11·7	1·9	40·1	7·8	9·8	2·9	11·7	0·9
96	52	25	38·7	·7	17	C	87	5·7	2·3	2·3	20·6	14·9	6·9	4·6	17·1	8·04
11—95	58	14	38·9	·3	15	A	114	14·0	6·1	1·7	21·9	3·4	11·4	7·0	14·0	2·6
96	57	20	38·7	·2	41	C	80	7·5	7·5	8·7	25·0	8·7	13·7	6·2	18·7	8·7

Dr. Malcolmson (Middlesborough) said he came from a place at the mouth of the Tees where they were troubled every spring with epidemics of bronchitis and pneumonia. So great had the pneumonia epidemic been that the Local Government Board had held extensive enquiries, and he found that instead of the east winds being beneficial, it was the exact reverse. So much was this the case that the inhabitants used the expression that it seemed like a pneumonia day. He attributed it, not so much to the cold, but to often getting bright sunshine and tolerable temperature during the day. and at night a cold fog and east wind up from the river and sea. It was the sudden variations of temperature, and not the extreme cold that was the cause of their pneumonia.

The President of the Section (Mr. W. H. Dines) said he was used to London fogs, and, having passed through Middlesborough and seen the smoke, he was not surprised to find pneumonia so prevalent there.

Dr. Gillespie (Edinburgh) said as far as he knew Edinburgh only educated people, printed books, and brewed beer, none of which gave rise to much smoke. Edinburgh air was very clear.

Mr. G. J. Symons (London) said they must recollect that the work done here had not all been done that day. Some of it had been done beforehand. Notably was that the case with the President who had honoured them by preparing the address. Fortunately, amongst those present were included the representatives of the Press. If we were only twenty or thirty persons in the room, there were through them 200,000, or more, who would eventually see and hear what was going on. He was quite sure those few who were left would all be quite unanimous in thanking Mr. Dines for the trouble he had taken to prepare the address, and for coming there to preside over the Section.

REVIEWS OF BOOKS.

A TEXT BOOK OF BACTERIOLOGY.*

This is, practically speaking, a new work, for the third edition has been so reconstructed, rewritten and enlarged, that one could scarcely recognise any likeness between it and the present volume.

It is primarily a text book for the Bacteriological Laboratory, and as such it is excellent; but the author goes also into the measures which should be taken to prevent the spread of disease, and this subject is so much better dealt with in so many other books, that the author would have done well to avoid it, and more especially as it would inevitably lead him to the discussion of a matter on which he holds views which are at variance with those held by the bulk of the medical profession. Everyone who reads the chapter upon smallpox will be impressed with a conviction that Professor Crookshank imagines that the importance of the early recognition of cases, and their prompt isolation as means of stamping out the disease, is not sufficiently appreciated—else why does he dwell so much upon this point, and quote, as he does, in support of it? The prime importance and value of these means have been recognised by one and all ever since the disease and its highly infectious nature have been known. Where Professor Crookshank is at issue with so many others is, that he does not believe that vaccination is the additional great means of checking the spread that the very large majority of medical men maintain it to be.

Referring to the recent epidemic in the parish of St. Marylebone, he writes:—"By the energy of the officials of the Board, this outbreak was suppressed in a few days by means of notification and immediate isolation." We are of opinion that those who had to deal with the epidemic ascribed a by no means unimportant place to the part which vaccination and re-vaccination also played in controlling its spread.

The author sets out to travel over a very wide domain; and doubtless the little which presents itself for adverse criticism stands out the bolder by reason of the general excellence of the volume.

It is a work which has already taken its place in the front rank of text-books of Bacteriology, and, in its present form, there is certainly no book, either British or Continental, which will better meet the requirements of the student.

The bibliography is valuable and good; the volume is most richly and admirably illustrated; and the manner of its production reflects great credit upon the publisher.

H. R. K.

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* A Text Book of Bacteriology, by Edward Crookshank, M.B., Professor of Comparative Pathology and Bacteriology at King's College, London. 4th edition. 8vo., 715 pp. H. K. Lewis, 1896. Price 21s. nett.

MICRO-ORGANISMS AND DISEASE.*

It follows that where a comparatively new study, of great and far-reaching importance, commands the attention of so many earnest and competent workers, that the science of the subject is very actively progressive; and under these circumstances a text book requires frequent revision if it is to be kept up to date.

The appearance of the fourth edition of Dr. Klein's book is very welcome—more especially as the fact that the author, who has identified himself so much with the work of the past decade, should permit ten years to elapse since he wrote the third edition, had led many to believe, and to fear, that this manual was going to be allowed to drop out of circulation. This would have been a distinct loss to the student, for the general arrangement of the book is well conceived, the subject is treated at the same time lucidly and concisely, and a large amount of information is bound up in a handy form.

The many strides which bacteriology has made since the appearance of the last edition of this work—more especially in the direction of what one may term the "chemistry" of the subject and the application of serum-therapeutics to communicable disease—are all dealt with in the present volume; and if there is anything left to be desired, it is a little more extension, in some places, of the subject-matter which deals with technical details.

H. R. K.

SANITARY HOUSE DRAINAGE: ITS PRINCIPLES AND PRACTICE.†

The author presents in book form the series of articles on this important subject which he recently contributed to "The Building News," and clearly sets forth the principles which should govern general design, and the construction in detail of House Drainage.

The first three chapters are devoted to general principles; then practical remarks on ventilation and the flushing of drains, followed by a consideration of the form and materials and the jointing of drain pipes; then details of laying drains, and inspection and intercepting chambers, continuing on soil, ventilating, and waste pipes, with some useful tables; and well illustrated pages on manhole covers, traps, sinks and gullies; then different types of water-closet apparatus are considered, and baths, housemaids' sinks and lavatories are next treated of; then urinals and latrines, and the author concludes a very practical, well written, and copiously illustrated little volume with two important chapters on testing new drains, and examining and testing old drains and sanitary appliances, his remarks on which are very thorough and exceedingly practical. In his own words, "Whilst it is essential that every drain and sanitary fitment in all its details shall be properly designed and constructed in accordance with the recognized principles of sanitary science, so that the whole may be absolutely efficient when first constructed,—yet, in the interests of health, it is also desirable that they should be periodically examined and tested (say once a year) by a thoroughly qualified sanitary expert . . . the usual practice being to defer such examination until it is unmistakeably realised that some hitherto unnoticed defect has been the cause of serious illness or disease, and which, had it been discovered in time, might have been easily remedied"; conclusions to which no one can offer objection, and to no buildings do such remarks apply more pertinently than to our military establishments, thus this little work coming from a member of the Royal Engineer staff is doubly welcome. It will take a foremost place among works of similar character, "whose name is legion," and may be confidently recommended as a safe and useful book of reference for all those who are engaged either in the study or the practice of sanitation as applied to drainage of houses.

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* Micro-organisms and Disease, by E. Klein, M.D., F.R.S., Lecturer on General Anatomy and Physiology in the Medical School of St. Bartholomew's Hospital, London. 4th edition, 8vo., 595 pp. Macmillan & Co., London. Price 8s. nett.

† Sanitary House Drainage: its Principles and Practice. By T. E. Coleman, Surveyor R.E. Civil Staff. 186 pp. 8vo., 98 illustrations. E. & F. N. Spon, London; Spon & Chamberlain, New York. 1896. Price 5s.

L. F.

NOTES ON BOOKS AND PAPERS IN TRANSACTIONS.

"Report of the Committee for Testing Smoke-Preventing Appliances." *Manchester*, 1895. *Price 5/-.*

This Report and the formation of the Committee is the outcome of a suggestion of the Chief Inspector under the Alkali, &c., Works Regulation Act (Mr. A. E. Fletcher), in his report for the year 1888, and of correspondence which appeared in the *Manchester Guardian.*

The Manchester and Salford Noxious Vapour Association organised meetings in Manchester and other large towns, with the result that a Committee was formed, with the Right Hon. Lord Egerton of Tatton as President. The scope of the work proposed to be carried out was as follows:—

To carry out practical examinations and tests, do produce, or are accompanied by—

(*a*) Practical freedom from smoke.
(*b*) Reasonable amount of duty.
(*c*) Economy of fuel.
(*d*) Moderate cost in wear and tear, and simplicity of construction.
(*e*) Moderate cost of application.

The Report consists principally of tables recording the results of the investigations carried out by the Committee.

MEETINGS HELD OCTOBER TO DECEMBER, 1896.

Sessional Meeting.

A meeting was held on December 9th, when a discussion was opened by Samuel Rideal, D.Sc., F.I.C., F.C.S., on "Soils, and their Suitability for Sewage Farms, with the Role of Bacteria in Sewage Disposal, especially referring to the Exeter Septic Tank Experiments." Prof. W. H. Corfield, M.A., M.D., in the Chair. About 120 Members, Associates, and Visitors attended. The paper and discussion will be printed in Part I., Vol. XVIII., of the Journal.

Lectures and Demonstrations to Sanitary Officers.

The Twenty-second London Course of 18 Lectures and 15 Practical Demonstrations and Visits of Inspection to trade premises, Refuse Disposal Works, commenced on September 28th. 79 Students entered their names for this course.

As a Supplement to the Lectures, the Council repeated the Practical Demonstrations on Meat Inspection and Diseases of Animals, which were conducted by W. A. Bond, M.A., M.D., D.P.H., Medical Officer of Health, Holborn.

Examinations.

At an Examination in Practical Sanitary Science, on December 4th and 5th, 1896, 25 Candidates presented themselves.

The following 15 Candidates were granted Certificates in Practical Sanitary Science :—

1896, Dec. 5. Allan, George Awburn, Junr., 25, Clipstone Street, Great Portland Street, W.
1896, Dec. 5. Beeson, Stephen Edward, Church Street, Rickmansworth.
1896, Dec. 5. Berrington, Ernest, Graiseley, Wolverhampton.
1896, Dec. 5. Endsor, Henry Arthur, Yardley Gobion, Stony Stratford, Bucks.
1896, Dec. 5. Higlett, Harry Shepard, 68a, Woodbridge Road, Guildford.
1896, Dec. 5. Hobday, Frederick Thomas George, Royal Veterinary College, Camden Town, N.W.
1896, Dec. 5. Lloyd-Davies, David Ernest, Wyre Court, Bewdley.
1896, Dec. 5. Mayell, Alfred Young, 18, Highfield Road, Dartford, Kent.
1896, Dec. 5. Mead, Charles Henry, 7, Peak Hill Gardens, Sydenham, S.E.
1896, Dec. 5. Smith, George Henry, 9, St. John's Road, Dover.
1896, Dec. 5. Smith, John Buckingham, 7, St. John's Road, Upper Holloway, N.

1896, Dec. 5. Strange, Edward Jeffery, 34, London Road, Tunbridge Wells.
1896, Dec. 5. Sutcliffe, George Lister, Heptonstall, Manchester.
1896, Dec. 5. Vine, Harry Arthur Edward, 87, Charlwood Street, Pimlico, S.W.
1896, Dec. 5. Warren, Archibald Ralph, 73, Breakspears Road, St. John's, S.E.

Examination Questions.

Practical Sanitary Science.—London, December 4th and 5th, 1896.

1.—What is the action of water upon the various materials used for cisterns? What would guide you in the choice of materials? What are the dangers likely to occur from the storage of water in cisterns?

2.—Name the different kinds of bricks used in building. What are the relative advantages of each?

3.—What are the component parts of—

(*a*) Pure atmospheric air;
(*b*) Pure water?

What are the usual sources of contamination of air and water in dwelling houses? What is the natural law as to the diffusion of gases?

4.—A room 16 ft. square and 10 ft. high, having two windows, a fireplace, a door, and three gas burners, is occupied daily by four persons during eight working hours. Describe briefly what steps should be taken to ensure constant and efficient ventilation without discomfort to the occupants—

(*a*) In summer;
(*b*) In winter.

5.—Describe some system of warming and ventilation of a hospital, asylum, or public building, on a natural (as distinguished from a mechanical) principle, explaining the methods for the admission of pure and the extraction of vitiated air.

6.—Describe the most approved principles of domestic drainage in connection with w.c.'s, sinks, baths, and rain-water pipes, and also the methods for preventing the admission of sewer-gas into dwellings.

7.—Describe and sketch plan and cross section of a disconnecting chamber with four inlets.

8.—Sketch a section showing how the drainage should be taken from the rear of a house to the front, the back yard being level with the street, the basement 9 ft. below the street level, with an area in the front, it being necessary to carry the drain under the house.

The Candidates were examined vivâ voce *on the 5th.*

At an Examination for Inspectors of Nuisances, held in London on Friday and Saturday, December 4th and 5th, 1896, 134 Candidates presented themselves.

The following 83 Candidates were certified, as regards their Sanitary knowledge competent to discharge the duties of Inspectors of Nuisances:—

1896, Dec. 5. Ackermann, Alfred Seabold Eli, 26, Colet Gardens, West Kensington, W.
1896, Dec. 5. Allan, Lewis Forsyth, "Chirbury," New Southgate, N.
1896, Dec. 5. Anderson, Joseph Glover, 26, Denmark Terrace, East Ham, E.
1896, Dec. 5. Anthony, Edward, 9, Oakington Road, Paddington, W.
1896, Dec. 5. Apps, Harry Mason, West Malling, Kent.
1896, Dec. 5. Baker, Arthur, 8, Caldecote Street, Newport Pagnell, Bucks.
1896, Dec. 5. Barnes, Thomas John, 43, Coopersale Road, Homerton, N.E.
1896, Dec. 5. Bartlett, James, 42, Paulin Street, Bermondsey, S.E.
1896, Dec. 5. Bates, Charles Penrose, 1, Taibach, Merthyr Tydvil, South Wales.
1896, Dec. 5. Baxter, Alexander Luard, 374, Kennington Road, Lambeth, S.E.
1896, Dec. 5. Blann, Albert Mercer, 54, Lisburne Road, Hampstead, N.W.
1896, Dec. 5. Branch, Thomas Anderson, Kirkaldy Villa, Hazelhurst, Road, Tooting, S.W.
1896, Dec. 5. Bush, Walter Ernest, 1, Chester Villas, Farnborough, Kent.
1896, Dec. 5. Cannell, Arthur Edward, Oak Villa, St. Hellesdon, Norwich.
1896, Dec. 5. Carter, Rowland Milfred William, Scarning School, East Dereham, Norfolk.
1896, Dec. 5. Cheetham, Albert, 6, Wallace Road, Canonbury, N.
1896, Dec. 5. Collier, Albert, 23, Culcheth Lane, Newton Heath, Manchester.
1896, Dec. 5. Connor, Mrs. Emma Laura, 2, Park Row, Greenwich, S.E.
1896, Dec. 5. Cornwell, Frederick Hoadley, 3, Canonbury Park North, N.
1896, Dec. 5. Cromwell, Edwin Oliver, 2, Hampton Villas, Worcester Park, Surrey.
1896, Dec. 5. Davis, William John, 17, Chestnut Road, Plumstead, S.E.
1896, Dec. 5. Deyns, Miss Bella, The Gables, Bletchley, Bucks.

1896, Dec. 5. Dobson, Miss Œnone, Glenaradale, North Finchley, N.
1896, Dec. 5. Dyke, Jas., 140, Forty Acre Lane, Canning Town, E.
1896, Dec. 5. Ensor, William Piercy, 2, Percy Square, Clerkenwell, E.C.
1896, Dec. 5. Finch, Ernest Edward, Town Hall, Spa Road, S.E.
1896, Dec. 5. Ford, William James, Mount Pleasant, 150, Walmer Road, Fratton, Portsmouth.
1896, Dec. 5. Frost, Charles Edwin, 135, High Street, Lewisham, S.E.
1896, Dec. 5. Gregory, George James, 62, Guildford Road, Kingston, Portsmouth.
1896, Dec. 5. Guiver, John Neal, 53, Strone Road, Forest Gate, E.
1896, Dec. 5. Hale, Edward John, 17, Coleridge Road, Crouch End, N.
1896, Dec. 5. Harlock, Miss Gulielma, Finedon, Wellingborough.
1896, Dec. 5. Harmer, John, 7, Drummond Road, Croydon.
1896, Dec. 5. Harmer, Walter Sydney, 163, Oval Road, East Croydon.
1896, Dec. 5. Heasman, Albert George, 3, Ardmere Cottage, Hether Green, S.E.
1896, Dec. 5. Hemmann, Fritz, 10, Bordyke, Tonbridge, Kent.
1896, Dec. 5. Hindes, Edward Johnson, Station Road, Beccles.
1896, Dec. 5. Hobson, Miss Rose Anne, 5, Endsleigh Street, Tavistock Square, W.C.
1896, Dec. 5. Hockley, Charles, Mountsorrell, Barry, Glamorganshire.
1896, Dec. 5. Hogg, Edwin Heckley, Cold Harbour, Nash, Newport, Monmouthshire.
1896, Dec. 5. Hunt, Miss Annie, 10, Montagu Place, Montagu Square, W.
1896, Dec. 5. Jackson, Frederick William, High Street, Bollington, near Macclesfield.
1896, Dec. 5. Kelly, James Francis, Brooklyn, Dagnan Road, Balham Hill, S.W.
1896, Dec. 5. Lee, Robert William, 3, Exmoor Road, Southampton.
1896, Dec. 5. Linch, David William, 45, Kingsdown Road, Leytonstone, N.E.
1896, Dec. 5. Lovett, Frank Robert, 34, Walmer Road, Fratton, Portsmouth.
1896, Dec. 5. Lyne, Jabez, 27, Glenavon Road, Stratford, E.
1896, Dec. 5. Martindale, Miss Hilda, 5m, Hyde Park Mansions, N.W.
1896, Dec. 5. Matthews, Douglas Samuel, 345, Fulham Road, S.W.
1896, Dec. 5. Mead, John J., 9, Belmont Road, New Brompton, Kent.

1896, Dec. 5. Milton, Walter Andrew, 10, Brookhill Road, Plumstead, S.E.
1896, Dec. 5. Molony, Frederick Arthur, 2, Linden Gardens, Hornsey Lane, Highgate, N.
1896, Dec. 5. Monkcom, Henry Charles, 2, Monmouth Road, North End, Portsmouth.
1896, Dec. 5. Morgan, Arthur Cecil, 37, Cornwall Road, Bayswater, W.
1896, Dec. 5. Nash, Fredk., 349, Wandsworth Road, S.W.
1896, Dec. 5. Neighbour, Herbert, 23, Dalling Road, Hammersmith.
1896, Dec. 5. Nighy, James, 14, Old Town, Croydon.
1896, Dec. 5. Odlum, Walter Edward, 93, Warwick Road, S.E.
1896, Dec. 5. Organ, Edward Hooper, Long Street, Wotton-under-Edge.
1896, Dec. 5. Perkins, Walter Philip, Milsington Villas, 44, Monson Road, Redhill, Surrey.
1896, Dec. 5. Pole, Miss Millicent Mary, Esklee, Rosslyn, Midlothian, Scotland.
1896, Dec. 5. Powell, Arthur Ernest, 13, Listria Park, Stoke Newington, N.
1896, Dec. 5. Ransom, Miss Dora Mildred, 10, Blomfield Street, Westbourne Terrace, W.
1896, Dec. 5. Reilly, George, 68, Thornhill Road, Barnsbury, N.
1896, Dec. 5. Ross, Harry A., 3, Park Street, Dorset Square, N.W.
1896, Dec. 5. Salter, Robert Baron, 237, Convamore Road, Grimsby.
1896, Dec. 5. Sanders, Herbert William, 92, Crawford Street, Bryanston Square, W.
1896, Dec. 5. Shaw, Arthur James, 58, Teviot Street, South Bromley, E.
1896, Dec. 5. Sibley, Miss Sarah Jane, Cuxton, Rochester, Kent.
1896, Dec. 5. Stebbings, Fuller, 10, Frances Avenue, Welstead Street, Hull.
1896, Dec. 5. Stovold, Frank, 112, Keppel Street, Chelsea, S.W.
1896, Dec. 5. Stroud, Arthur, 23, Grosvenor Road, Richmond, Surrey.
1896, Dec. 5. Stupart, Charles Walter, 4, Plymouth Road, Totnes, South Devon.
1896, Dec. 5. Sutton, George, Pelsall, Walsall.
1896, Dec. 5. Taylor, William Wells, 48, Burnfoot Avenue, Munster Road, Fulham, S.W.
1895, Dec. 5, Tracey, Miss Anna, 29, St. Stephen's Mansions, Westminster, S.W.
1896, Dec. 5. Thornhill, George Edwin, Christchurch Workhouse Infirmary, Blackfriars, S.E.
1896, Dec. 5. Waterman, Richard Henry, 31, Annerley Terrace, Somers Road North, Portsmouth.
1896, Dec. 5. West, Horace George, 5, Kelross Road, Highbury New Park, N.

1896, Dec. 5. Whitworth, William, Codsall Cottage, Cradley Heath, Staff.
1896, Dec. 5. Wilson, Jason Charles, 72, Margaret Street, W.
1896, Dec. 5. Windred, Albert, 1, Dixon Road, New Cross, S.E.
1896, Dec. 5. Yorke, Thomas, Washbrook Road, Rushden.

A complete list is published and can be obtained at the Offices of the Institute.

Examination Questions.

Inspectors of Nuisances.—London, December 4th and 5th, 1896.

1.—State the difference between a By-law and a Regulation under the Public Health Act, 1875. State the matters which should be dealt with in any Regulations for the control of slaughter-houses.

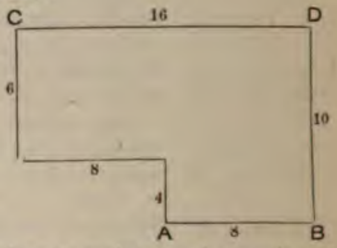
2.—Mention three offensive trades. Describe in each case what it is that causes or is likely to cause offence.

3.—How would you proceed to investigate a complaint as to smoke from the chimney of a factory? State exactly and fully the particulars you would ascertain.

4.—What are the characteristics of good meat? What would you do if you found unsound meat exposed for sale?

5.—How would you proceed to deal with a house in which a case of typhus fever or small-pox had occurred?

6.—What is the cubic content of an attic-room of the form shown in the plan? The wall A B being 8 ft. in height, and the wall C D 13 ft. in height; the ceiling sloping up regularly from A B to C D.



7.—What precautions should be taken to maintain the purity of water in storage cisterns? State the various materials of which cisterns for drinking water are made, and conditions under which each material should be used.

8.—What are the definitions given of "Sewer" and "Drain" in the Metropolis Local Management Act, 1855, and in the Public Health Act, 1875?

9.—What are the essentials of a good water-closet? Describe or illustrate by sketches three kinds in general use.

The Candidates were examined vivâ voce *on the 5th.*

At an Examination in Practical Sanitary Science, held at Liverpool, on December 18th and 19th. 1896, 4 Candidates presented themselves. Questions were set to be answered in writing on the 18th, and the Candidates were examined *vivâ voce* on the 19th.

The following Candidate was granted a Certificate in Practical Sanitary Science:—

1896, Dec. 19. **Hargreaves, John Emanuel**, 48, Williams Road, Burnley.

At an Examination for Inspectors of Nuisances, held at Liverpool on Friday and Saturday, December 18th and 19th, 1896, 69 Candidates presented themselves.

The following 39 Candidates were certified, as regards their Sanitary Knowledge, competent to discharge the duties of Inspectors of Nuisances:—

1896, Dec. 19. **Bellamy, Herbert Ernest**, 66, Chapel Street, St. Helens, Lancashire.
1896, Dec. 19. **Booth, George Arthur**, 6, Richmond Terrace, Ulverston.
1896, Dec. 19. **Bowker, Walter Stanley**, 22, Shakespeare Crescent, Patricroft.
1896, Dec. 19. **Cattroll, Alfred**, 281, Burlington Street, Liverpool.
1896, Dec. 19. **Charlesworth, Reeves**, 99, Beechwood Road, Hillsboro', Sheffield.
1886, Dec. 19. **Corlett, Thomas**, 60, Ponsonby Street, Liverpool.
1896, Dec. 19. **Dandy, Joseph Henry**, 421, Hawthorne Road, Bootle, Liverpool.
1896, Dec. 19. **Dawkin, James Mansel**, 7, Lucerne Road, Seacombe, Cheshire.
1896, Dec. 19. **De-la-Motte, Freeman Alexander**, Gordon Avenue, Southampton.
1896, Dec. 19. **Dickson, John George**, 37, Buccleuch Street, Dumfries.
1896, Dec. 19. **Ellwood, Jason**, Ewbank View, Kirkby Stephen.
1896, Dec. 19. **Fallows, Joseph**, 102, Beatrice Street, Bootle. Liverpool.
1896, Dec. 19. **Faulder, Mark**, Woodland View, near Sheffield.
1896, Dec. 19. **Fitzpatrick, Frederick Moore**, 23, Ludwig Road, Liverpool.
1896, Dec. 19. **Fothergill, James Edward**, 8, Cross Mount Street, Warwick Road, Batley.
1896, Dec. 19. **Graham, Henry**, Harrington, Cumberland.

1896, Dec. 19. Graham, Thomas, 20, Alfred Road, Birkenhead.
1896, Dec. 19. Grimbley, John, 59, Winson Green Road, Birmingham.
1896, Dec. 19. Halstead, Bannister, 51, Crowther St., Burnley.
1896, Dec. 19. Harrison, James William, Oak Cottage, Barlow Road, Keighley.
1896, Dec. 19. Hughes, Alfred, 24, Egerton Road, New Ferry, Cheshire.
1896, Dec. 19. Hull, Richard Norris, 17, Carlton Street, Preston.
1896, Dec. 19. Jones, Henry, 7, Ruby Street, Toxteth Park, Liverpool.
1896, Dec. 19. Jump, Richard, 9, Belford Street, Burnley.
1896, Dec. 19. Jump, Samuel, 173, Whalley Range, Blackburn.
1896, Dec. 19. Kissack, Thomas, 16, Torr Street, Liverpool.
1896, Dec. 19. May, James Henry, 7, Fox Street, Edgeley, Stockport.
1896, Dec. 19. Pickering, Thomas Farmer, 22, Alma Street, Wolverhampton.
1896, Dec. 19. Rogerson, John William, Beech House, Dentons, Green Lane, St. Helens.
1896, Dec. 19. Russell, Thomas Edgar, 8, Everton Valley, Liverpool.
1896, Dec. 19. Simmons, Richard, Abenbury Lodge, Wrexham.
1896, Dec. 19. Smith, Alfred, 97, Linaker Street, Southport.
1896, Dec. 19. Swain, Walter, 2a, Mount Street, Rochdale, Lancashire.
1896, Dec. 19. Tattersall, Miss Alice, 4, Maple Avenue, Chorlton-cum-Hardy, Manchester.
1896, Dec. 19. Teebay, Miss Alice, Purston Vicarage, Pontefract.
1896, Dec. 19. Williams, Owen Henry, 9, Geraldine Street, Blackburn.
1896, Dec. 19. Williams, John Rowland, 54, Grinshill Street, Liverpool S.
1896, Dec. 19. Windass, John William, Longford, Foleshill, near Coventry.
1896, Dec. 19. Yelland, Adolph John, 7, Gladstone Road, Seacombe.

The Candidates were examined vivâ voce *on the* 19*th.*

Examination Questions.

Practical Sanitary Science.—Liverpool, December 18th and 19th, 1896.

1.—State the relative advantages and disadvantages of gravel, sand, clay, and chalk formations as sites for dwelling-houses. How are these conditions affected by the immediately underlying stratum?

2.—State the pressure per square inch at the bottom, and at thirty feet from the bottom in a pipe full of water fifty feet in length fixed vertically. What weight per yard of lead soil-pipe should be used for various diameters respectively?

3.—What is a "damp-course"? What is its object? and in what position should it be placed under the varying circumstances of different buildings? Of what materials may it be constructed?

4.—What provisions are desirable with regard to window space in living-rooms, and what are the Sanitary advantages and disadvantages of the various kinds of windows in general use? How can any of these forms of windows be adapted for the purpose of ventilation?

5.—Describe, with sketch, a ventilating close stove. Contrast heating by open fire-places and by stoves.

6.—Describe a method of ascertaining whether the drains under a dwelling-house allow the escape of sewage pollution. What are the ordinary sources of contamination of the soil forming the sites of houses, and by what precautions may contamination be prevented?

7.—In what circumstances should iron pipes be used for drainage in preference to stone-ware? What means are adopted to prevent corrosion in iron pipes? Describe, with sketch, the method of jointing iron pipes.

8.—Describe the size and construction of a portable dust-bin that would conform with the Bye-Laws of the London County Council.

The Candidates were examined vivâ voce *on the 19th.*

Examination for Inspectors of Nuisances.—Liverpool, December 18th and 19th, 1896.

1.—What difference is there in the powers of Urban and Rural Sanitary Authorities respectively with regard to—

(*a*) Water supply;
(*b*) Pig keeping;
(*c*) Public conveniences?

2.—To what points would you direct yonr attention in inspecting the following trades—

Gut scraping;
The manufacture of artificial manure.

3.—What are the signs apparent to the naked eye of Tubercle in the carcass of an animal? Where would you look for evidence of the disease?

4. It is considered advisable after a case of Typhoid Fever to disinfect and purify the whole of the sanitary arrangements of a

house. State what steps should be taken to carry this out in regard to water-closets, soil-pipes, drains, gullies, sinks, baths, lavatory basins, and waste-pipes.

5.—How would you respectively disinfect—

(*a*) Bed linen;
(*b*) Blankets;
(*c*) Mattresses;
(*d*) Wearing apparel;
(*e*) Infected excreta?

6.—How many gallons of water would be required to fill a pipe-drain four inches in diameter and fifty feet in length?

7.—What are the most common causes of pollution of water in wells, and water butts outside, and cisterns inside houses? What steps would you take to prevent pollution in each case?

8.—A well is suspected to be polluted by leakage from a drain which passes within ten feet of it. Explain exactly step by step what investigations you would make, and how you would carry them out.

9.—Describe a good form of Earth-closet. State the conditions under which it would be desirable to provide an Earth-closet in preference to any other form.

The Candidates were examined vivâ voce *on the 19th.*

FORTHCOMING MEETINGS.

CALENDAR, JANUARY TO APRIL, 1897.

As far as at present arranged.

The Ordinary General Meeting will be held on Wednesday, March 24th, at 5 p.m.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.

Finance Committee . . .	Second Wednesday at 4 p.m.
Exhibition Committee . . .	First Tuesday at 5 p.m.
Congress and Editing Committee .	Second Monday at 5.15 p.m.
Education Committee . . .	Third Monday at 5 p.m.
Museum and Library Committee .	Fourth Monday at 5 p.m.

FEBRUARY.

5 F. }
6 S. } Examinations in Practical Sanitary Science and for Inspectors of Nuisances, Swansea.

10 W. Sessional Meeting at 8 p.m. Paper by F. J. Waldo, M.A., M.D., D.P.H., on "Sanitary Supervision of Shelters for the Homeless."

15 M. Introductory Lecture to Sanitary Officers at 8 p.m., on Factory Legislation, by A. Wynter Blyth, Barrister-at-Law.

18 T. Lecture to Sanitary Officers at 8 p.m. Sanitary Law: English, Scotch, and Irish; General Enactments; Public Health Act, 1875: Model Bye-Laws, &c., by Herbert Manley, M.A. (Cantab.), M.B., D.P.H.

22 M. Lecture to Sanitary Officers at 8 p.m. The Law relating to the Supervision of Food Supply, by A. Wynter Blyth, Barrister-at-Law.

24 W. Inspection and Demonstration in the Parish of St. George's, Hanover Square, at 2 p.m. Conducted by Albert Taylor.

25 T. Lecture to Sanitary Officers at 8 p.m. Sanitary Laws and Regulations governing the Metropolis, by A. Wynter Blyth, Barrister-at-Law.

27 S. Inspection and Demonstration.

MARCH.

1 M. Lecture to Sanitary Officers at 8 p.m. Nature of Nuisances, including Nuisances the abatement of which is difficult, by Arthur Newsholme, M.D., M.R.C.S., D.P.H.

4 T. Lecture to Sanitary Officers at 8 p.m. Objects and Methods of Inspection, by J. F. J. Sykes, D.SC., M.D.

6 S. Inspection and Demonstration at the Marylebone Stoneyard at 3 p.m. Conducted by C. J. Kilgallin.

8 M. Lecture to Sanitary Officers at 8 p.m. Factories and Workshops and Offensive Trades, by Prof. A. Bostock Hill, M.D., D.P.H.

10 W. Inspection and Demonstration at Lacy's Disinfecting Works and Steam Laundry, St. John's Wharf, Fulham, at 3 p.m.

10 W. Sessional Meeting at 8 p.m.

13 S. Inspection and Demonstration at Aylesbury Dairy Co.'s premises, Bayswater (number limited), at 3 p.m.

15 M. Lecture to Sanitary Officers at 8 p.m. Diseases of Animals in relation to Meat supply; characteristics of Vegetables, Fish, &c., unfit for food, by Alfred Hill, M.D., F.R.S.E.

18 T. Lecture to Sanitary Officers at 8 p.m. Infectious Diseases and Methods of Disinfection, by H. R. Kenwood, M.B., D.P.H., F.C.S.

19 F. } Examinations in Practical Sanitary Science and for Inspectors of
20 S. } Nuisances, Glasgow.

20 S. Inspection and Demonstration at the Friern Barnet Sewage Works, at 3 p.m. Conducted by E. J. Reynolds, ASSOC.M.INST.C.E.

22 M. Lecture to Sanitary Officers at 8 p.m. Water Supply, Drinking Water Pollution of Water, by Prof. W. H. Corfield, M.A., M.D. (Oxon), F.R.C.P.

24 W. **Ordinary General Meeting at 5 p.m.**

25 T. Inspection and Demonstration at the Metropolitan Cattle Market, York Road, N., at 3 p.m.

Demonstration of Diseased Meat, at the Parkes Museum, at 8 p.m., by W. A. Bond, M.A., M.D., D.P.H.

27 S. Inspection and Demonstration at Harrison and Barber's Knacker yard, Whitechapel, at 3 p.m.

29 M. Lecture to Sanitary Officers at 8 p.m. Ventilation, Warming and Lighting, by Joseph Priestley, B.A., M.D., D.P.H.

31 W. Inspection and Demonstration in the Parish of St. George's, Hanover Square, at 2 p.m. Conducted by Albert Taylor.

APRIL.

1 T. Lecture to Sanitary Officers at 8 p.m. Principles of Calculating Areas, Cubic Spaces, &c.; Interpretations of Plans and Sections to Scale, by J. Wallace Peggs, ASSOC.M.INST.C.E.

3 S. Inspection and Demonstration at Aylesbury Dairy Co.'s premises. Bayswater (number limited), at 3 p.m.

5 M. Lecture to Sanitary Officers at 8 p.m. Sanitary Building Construction, by Prof. T. Roger Smith, F.R.I.B.A.

7 W. Inspection and Demonstration at Chelsea Disinfecting Station, Lots Road, at 3 p.m. Conducted by Louis Parkes, M.D., D.P.H.

8 T. Lecture to Sanitary Officers at 8 p.m. Details of Plumbers' Work, by J. Wright Clarke.

9 F. }
10 S. } Examinations in Practical Sanitary Science and for Inspectors of Nuisances, Birmingham.

10 S. Inspection and Demonstration at the Sewage and Destructor Works, Ealing, at 2.30 p.m. Conducted by Charles Jones, M.INST.C.E.

12 M. Lecture to Sanitary Officers at 8 p.m. Sanitary Appliances, by George Reid, M.D., D.P.H.

14 W. Inspection and Demonstration at Artizans' Dwellings in Boundary Street Aven., Bethnal Green, conducted by Owen Henning, A.R.I.B.A.

16 F. *Good Friday.*

19 M. *Easter Monday.*

22 T. Lecture to Sanitary Officers at 8 p.m. House Drainage, by W. C. Tyndale, M.INST.C.E.

24 S. Inspection and Demonstration at Beddington Sewage Farm, Croydon. Conducted by Thos. Walker, M.INST.C.E.

26 M. Lecture to Sanitary Officers at 8 p.m. Sewerage and Sewage Disposal, by Prof. Henry Robinson, M.INST.C.E.

29 T. Lecture to Sanitary Officers at 8 p.m. Scavenging: Disposal of House Refuse, by Charles Mason, ASSOC.M.INST.C.E., A.R.I.B.A.

MAY.

1 S. Inspection and Demonstration at Sewage Outfall Works, Barking. Conducted by Jno. Ed. Worth, M.INST.C.E.

7 F. }
8 S. } Examinations for Practical Sanitary Science and for Inspectors of Nuisances, London.

FELLOWS, MEMBERS, AND ASSOCIATES ELECTED.

From OCTOBER to DECEMBER, 1896, Inclusive.

FELLOWS (FELLOW SAN. INST.)

665 1896. Nov. ADAMS, Prof. HENRY, M.INST.C.E, F.S.I., 60, *Queen Victoria Street, E.C.*

931 1896. Dec. PRIESTLEY, J., B.A., M.D., M.R.C.S., D.P.H., M.O.H., *Vestry Hall, Lambeth, S.E.*

562 1896. Nov. WILLIAMS, William, M.A., M.D., D.P.H., M.R.C.S., *County Offices, Penarth, Cardiff.*

MEMBERS (MEM. SAN. INST.)

* Passed Examination in Practical Sanitary Science.
† Passed Examination as Local Surveyor.
‡ Passed Examination as Inspector of Nuisances.

1001 1896. Nov. ANNIS, Ernest George, L.R.C.P., M.R.C.S., L.S.A., D.P.H., M.O.H., *Huddersfield, Yorkshire.*

1008 1896. Nov. BABST, Charles Theodore Uvo., L.R.C.P., L.R.C.S., *Medical Officer of Health, Norman House, Willington-on-Tyne.*

994 1896. Oct. **Balfour**, David, M.INST.C.E., F.G.S., F.R.M.S., *Newcastle-on-Tyne.*

1002 1896. Nov. **Blackshaw**, Walter, ASSOC.M.INST.C.E., *Assistant Borough Surveyor*, 65, *Thornhill Road, Croydon.*

1012 1896. Nov. **Blackshaw**, Wm., ASSOC.M.INST.C.E., *Borough Engineer and Surveyor, Stafford.*

999 1896. Nov. **Bourke**, Surg. Lieut.-Col. G. Deane, *Sanitary Officer for Barracks and Quarters, York, Army Medical Staff, York.*

1004 1896. Nov. **Bradshaw**, F. E. G., CERT.M. & C.ENG., *Surveyor and Inspector of Nuisances, Ashleigh, Frome Road, and Town Hall, Trowbridge.*

1014 1896. Nov. **Childs**, Christopher, M.D., D.P.H., 10, *Manchester Square, W.*

1023 1896. Dec. **Cook**, J. Neild, D.P.H. (CAMB.), L.R.C.P. (LOND.), M.R.C.S.(ENG.), *Health Department, Madras Municipality, India.*

1020 1896. Dec. **Dalton**, John Palmer, CERT. M. AND C. ENG., *Civil Engineer and Surveyor, Ryton-on-Tyne, Durham.*

995 1896. Oct. **Dunscombe**, Nicholas, ASSOC.M.INST.C.E., *Borough Engineer, Chesterfield, Derby.*

1017 1896. Nov. **Fergusson**, James Hugh, F.R.C.S.I., D.P.H., M.O.H., *Killigordon, Co. Donegal.*

1010 1896. Nov. **Garstang**, T.W. H., M.R.C.S., L.S.A., M.O.H., *Bucklow, Knutsford, Chester.*

1015 1896. Nov. †‡**Gathercole**, W. H. J., 141, *Rendlesham Road, Clapton, N.E.*

1019 1896. Dec. **Hellawell**, Oscar, CERT. M. & C. ENG., *Town Hall, Withington, Lancs.*

1003 1896. Nov. **Henry**, Joseph, M.D., L.R.C.S.I., M.O.H., 107, *Drake Street, Rochdale.*

1024 1896. Dec. ***Hudson**, E. R., 12, *Whitehall Place, S.W.*

1006 1896. Nov. **Jones**, George, M.A., M.B., D.P.H., 8, *Church Terrace, Brandram Road, Lee, S.E.*

1008 1896. Nov. **Livingstone**, Thomas, M.D., J.P., M.O.H., *Stanhope, viâ Darlington.*

1021 1896. Dec. **Mather**, Samuel, ASSOC.M.INST.C.E., *District Surveyor, Victoria Road, Surbiton, Surrey.*

1022 1896. Dec. **May**, F. J. C., M.INST.C.E., *Borough Engineer, Brighton.*

1011 1896. Nov. **Nettle**, Wm., M.R.C.S., L.S.A., M.O.H., J.P., *Liskeard, Cornwall.*

1009 1896. Nov. **Oliver**, Thomas, M.D., 7, *Ellison Place, Newcastle-on-Tyne.*

1018 1896. Nov. **O'Shaughnessy**, James Edward, M.INST.C.E., *Bangalore, Madras.*

1000 1896. Nov. **Peck**, Herbert, L.R.C.P., L.R.C.S., D.P.H.(CAMB.), *Medical Officer of Health, Aughton, Ormskirk, Lancs.*

996 1896. Oct. ***Ratcliffe**, J. C., *Holly Lea, Longfield, Urmston, Lancashire.*

1016 1896. Nov. RICHARDS, Meredith, M.D., M.O.H., *Chesterfield, Derby.*

1013 1896. Nov. ROBERTS, R. O. Wynne, ASSOC.M.INST.C.E., *Borough Engineer, Oswestry.*

1007 1896. Nov. SASSE, George Henry, *Borough Surveyor, Municipal Offices, Chelmsford.*

998 1896. Nov. SCURFIELD, Harold, M.D., C.M.(EDIN.), D.P.H.(CAMB.), *Medical Officer of Health for County Borough of Sunderland*, 9, *Rectory Terrace, Sunderland.*

997 1896. Nov. SPROT, Lieut.-Gen. J., *Riddell, Lilliesleaf, Roxburgh, N.B.*

ASSOCIATES (ASSOC. SAN. INST.)

‡ Passed Examination as Inspector of Nuisances.

1460 1896. Nov. ‡BANNISTER, Tom, 66, *Ovenden Road, Halifax, Yorks.*

1462 1896. Nov. ‡BIGGINS, Robert, *Inspector of Nuisances, Blaydon-on-Tyne.*

1474 1896. Nov. ‡BILLING, George Timothy, *Holborn Town Hall, Gray's Inn Road, W.C.*

1454 1896. Nov. ‡BOND, Ernest Henry, 24, *Church Road, Waterloo, Liverpool.*

1469 1896. Nov. ‡BROOKSHAW, Samuel, 118, *Corporation Street, Manchester.*

1449 1896. Nov. ‡BROWN, William, 6, *Prospect Place, Worthing.*

1446 1896. Nov. ‡BURR, Edwin John, 25, *Strafford Street, Newtown, Bristol.*

1479 1896. Dec. ‡COOPER, William White, *Bedlington, Newcastle-upon-Tyne.*

1468 1896. Nov. ‡CRAGHILL, Thomas Henry, 9, *St. John's Hill. Shrewsbury.*

1470 1896. Nov. ‡DANSON, John Henry, 14, *Marsh Hill, Homerton, N.E.*

1451 1896. Nov. ‡DAVIES, William Bowen, 2, *Commercial Street, Neath, Glamorgan.*

1456 1896. Nov. ‡DE KEY, John Edward Hamilton, *Old Hill, Staffs.*

1428 1896. Oct. ‡DICKINSON, Arthur James, *Town Hall, Sheffield, Yorkshire.*

1450 1895. Nov. ‡DIVER, Daniel John, 105, *Ewart Road, Forest Hill, S.E.*

1464 1896. Nov. ‡DOLBY, Alfred, 119, *Grove Green Road, Leytonstone, Essex.*

1447 1896. Nov. ‡DOUGLAS, James Wightman, *The Willows, Alnwick.*

1467 1896. Nov. ‡DRUMMOND, Alfred Edwin, 27, *Heworth Green, York.*

1441 1896. Nov. ‡EDWARDS, John Herbert, 31, *Talbot Road, Wrexham, Denbigh.*

1439 1896. Nov. ‡ELLIS, W. Baxter, 31, *Manley Grove, Stratford, Essex.*

1473 1896. Nov. ‡Flinn, Fred. Faulkner, 24, *Margaretta Terrace, Chelsea, S.W.*
1463 1896. Nov. ‡Gout, George, *Beilby House, Highgate, Cleethorpes, Lincoln.*
1442 1896. Nov. ‡Hayes, Frederick William, *Orleton, Worcester Road, Gt. Malvern.*
1457 1896. Nov. ‡Hinchcliffe, Daniel, 2, *Rayner Terrace, Lowtown, Pudsey, near Leeds.*
1440 1896. Nov. ‡Hobson, Ezra, *Wadsley, near Sheffield.*
1475 1896. Dec. ‡Hodges, Arthur, 23, *Fore Street, Barnstaple, Devon.*
1429 1896. Oct. ‡Horsfield, Jonathan Patchett, *Sanitary Inspector, King William's Town, Cape Colony.*
1430 1896. Oct. ‡Howes, William Winder, 44, *Hardy Street, Maidstone.*
1476 1896. Dec. ‡Humphery, J. P., *Town Hall, Reigate.*
1477 1896. Dec. ‡Kenealy, Miss H., *St. Andrew's, Watford, Herts.*
1452 1896. Nov. ‡Kirkup, John Little, *Cemetery Lodge, Wingate R. S. O., Ferry Hill, Durham.*
1431 1896. Oct. ‡Knewstubb, Joseph John, *Pembroke Street, Appleby.*
1478 1896. Dec. ‡Lawrence, Frank J., *Waltham, Blakenay Road, Beckenham, Kent.*
1439 1896. Nov. ‡Mathieson, David John, 11, *Little Welbeck Street, W.*
1453 1896. Nov. ‡Matthews, Ernest Romney, *Town Hall, Hastings.*
1432 1896. Oct. ‡Mease, Joseph Mellanby, *Seven Valley, Hutton Rudby, viâ Yarm, York.*
1459 1896. Nov. ‡Morgan, W. J., *Penrice, Reynoldstone R. S. O., Glamorgan.*
1471 1896. Nov. ‡Newman, Joseph J., 73, *Manor Road, Brockley, S.E.*
1472 1896. Nov. ‡Parker, Howard, *Moorlands, The Park, Buxton.*
1444 1896. Nov. ‡Pighills, Edward Smith, 32, *Langsdale Street, Liverpool.*
1433 1896. Oct. ‡Porter, Thomas Gabriel, 6, *Jackson Road, Holloway, N.*
1445 1896. Nov. ‡Pratt, Thomas Henry, 64, *Romilly Road, Finsbury, Park, N.*
1434 1896. Oct. ‡Rain, Frank Eras., 2, *Harrogate Street, Sunderland.*
1435 1896. Oct. ‡Salt, Arthur, 67, *Bloomsbury Street, Birmingham.*
1436 1896. Oct. ‡Shepherd, William, 5, *Church Row, Hampstead, N.W.*
1437 1896. Nov. ‡Smith, Wm. James, 36, *Coventry Road, Market Harborough.*
1465 1896. Nov. ‡Thackray, J. W., 3, *Rosington Place, Leeds.*
1449 1896. Nov. ‡Thomas, William, *Gellia, Cadoxton, Neath, Cardiff.*
1443 1896. Nov. ‡Thorpe, William, 156, *Lighthouse Road, Moston.*
1455 1896. Nov. ‡Wilcockson, Albert E., 12, *Andrew Street, Middleton Junction, Lancs.*

1459 1896. Nov. ‡Wildig, Hugh, *Laburnam Cottage, Christleton, Chester.*
1460 1896. Nov. ‡Williams, Daniel Thomas, *Post Office, Blaenclydach, Llwynypia, Glamorgan.*
1461 1896. Nov. ‡Williams, Griffiths, 3, *Well Lane, Rock Ferry, Chester.*

A complete List of Fellows, Members and Associates can be obtained at the Offices of the Institute.

OBITUARY.

Sir BENJAMIN WARD RICHARDSON, M.D., F.R.S., F.R.C.P.,

Was connected with this Institute almost from its commencement; he was Chairman of Council from 1877 to 1881, Vice-President from 1882-1892, President of the Congresses at Leamington (1877) and at Croydon (1879).

He devoted much attention for many years to the popularisation of knowledge of matters relating to the public health, and even started and edited for some years the *Journal of Public Health.* At the meeting of the Social Science Congress at Brighton, in 1875, he gave an address of an ideal city of health which he called Hygeia, an address which—like so many of his utterances—attracted a great deal of attention.

He was for some years President of the Sanitary Inspectors' Association, and was Honorary Physician to a number of philanthropic institutions.

He devised a simple and ingenious apparatus for producing local anæsthesia, and introduced bichloride of methylene as an anæsthetic; but the most practical result of his experiments on anæsthetics was the construction of the lethal chamber now in use at the Home for Lost Dogs, by means of which animals (dogs, cats, etc.) no longer wanted are painlessly disposed of.

For many years he was a total abstainer and an apostle of temperance, and was a living example of the fact that gaiety of spirits and geniality of disposition are not inseparably connected with wine. Sir Benjamin was indeed a most agreeable companion; few men have read as widely or as deeply as he the literature of medicine and the allied sciences, and being endowed with a prodigious memory, a strong sense of humour, and great conversational power, he was a first-class "raconteur," and an excellent after-dinner speaker: he was a man whose place it will be very difficult, nay impossible, to adequately fill. W. H. C.

EXHIBITS ADDED TO THE MUSEUM.

OCTOBER—DECEMBER, 1896, INCLUSIVE.

DIVISION A.

Physics.

Dissected Cone. To illustrate the measurement of cubic space.

DIVISION C.

Wall Coverings.

Alabastine Distemper (Church's Patent). The Walls of a small annexe have been treated with this preparation. *J. Line & Sons.*

DIVISION D.

Food.

Milk Sterilizer. *Aymard & Co.*

Milk Sterilizer. Designed by C. W. Cathcart, F.R.C.S., with special arrangement for keeping the milk in a sterilized condition. *Down Bros.*

Milk Sterilizer. With Spirit Lamp. *J. Seething.*

Milk Sterilizer (Soxhlett's). The milk is sterilized in small glass bottles, and India rubber Capsules prevent the absorption of air after the process. *Bailey Bros.*

Diseased Meat. Several specimens, including Liver of an Ox with the Hydatid from the Tapeworm of a Dog or Sheep. Tubercle in the Udder of a Cow. Tubercle in the Spleen. Tubercle in the Bone of Pig. Fluke in Liver of Sheep.

Sick Room Appliances.

Ice Cup (The Louise Patent). By keeping the ice out of water disintegration is delayed and the ice economised. *Down Bros.*

Domestic Appliances.

Washer (The "Torrent") Automatic. Mackey's Patent. Consisting of a pot or boiler with smaller vessel fitted inside, leaving a space between the two; when steam is generated it passes up this space and carries the hot water into the inner vessel through holes near the top, and through a hole in the bottom the water flows back into the outer vessel, so that there is a continual circulation of water in the inner vessel. *Mrs. Mackey.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY

FROM OCTOBER TO DECEMBER INCLUSIVE.

⁂ *For publications of Societies and Institutions, &c., see under "Academies."*

ACADEMIES (AMERICAN).

Manitoba. *Historical and Scientific Society of.* Annual Reports, 1894 and 1895. 22 and 32 pp., 8vo. Winnipeg, 1895 and 1896. *The Society.*

Toronto. *The Canadian Institute.* Transactions of. No. 9, Vol. V., Part 1. 165 pp., 8vo. Toronto, 1896. *The Institute.*

ACADEMIES (AUSTRALIAN).

New South Wales. *Royal Society of.* Journal and Proceedings. Vol. XXIX., 1895. 600 pp., 8vo. Sydney, 1896. *The Society.*

ACADEMIES (BRITISH).

Glasgow. *The Institution of Engineers and Shipbuilders in Scotland.* Transactions, Vol. XXXIX., 1895-96. 333 pp., 8vo. Glasgow, 1896. *The Institution.*

London. *City of London College.* Calendar for 1896-7. 180 pp., 8vo. London, 1896. *The College.*

——— *Museums Association.* Report of Proceedings, with the Papers read at the Seventh Annual Meeting, held in Glasgow, July 21-25, 1896. 167 pp., 8vo. London, 1896. *Purchased.*

——— *Royal College of Surgeons of England.* Calendar of, August, 1896. 324 pp., 8vo. London, 1896. *The College.*

——— *Royal Institute of British Architects.* Kalendar, 1896—97. 332 pp., 8vo. London, 1896. *The Institute.*

——— *The Institution of Civil Engineers.* Minutes of Proceedings. Vol. CXXVI., 1895—96. Part IV. 524 pp., 8vo. London, 1896. *The Institution.*

——— *The Medical Society of.* Transactions, Vol. XIX. 433 pp., 8vo. London, 1896. *The Society.*

——— *University College.* Calendar, Session, 1896-7. 462 pp., 8vo. London, 1896. *The College.*

ACADEMIES (CONTINENTAL).

Brussels. *Ministère de l'Agriculture et des Travaux publics.* Rapports des Commissions Médicales Provinciales sur leurs Travaux pendant l'année, 1895, précédés des Observations de l'Académie Royale de Médecine et du Conseil Supérieur d'Hygiène Publique. 537 pp., 8vo. Bruxelles. *Ministère de l'Agriculture.*

Board of Agriculture. Agricultural Returns: Statistical Tables, showing Acreage under Crops and Grass, Number of Horses, Cattle, Sheep and Pigs in the United Kingdom, with particulars for each County of Great Britain, 1896. 39 pp., 8vo. London, 1896.

——— Annual Reports of Proceedings under the Diseases of Animals Act, 1894. The Markets and Fairs (weighing of cattle) Acts, etc., etc., for the year 1895. 110 pp., 8vo. London, 1896. *The Board.*

Bryce, *George, LL.D.* Worthies of Old Red River. (Transactions No. 48, February 11th, 1896.) 12 pp., 8vo. Winnipeg, 1896. *The Historical and Scientific Society of Manitoba.*

Calniescu, *M.D., et* **Potarca,** *Jacob.* Description et Fonctionnement de l'Hôpital Central de l'Armée Roumaine. 35 pp., 4to. Bucarest, 1896. *George Pernet, M.R.C.S.*

Coleman, *T. E.* Sanitary House Drainage: its Principles and Practice. 186 pp. London, 1896. *The Author.*

Crookshank, *Edgar M., M.B.* A Text-Book of Bacteriology, including the Etiology and Prevention of Infective Diseases, and a short account of Yeasts and Moulds, Hœmatozoa and Psorosperms. 715 pp. London, 1896. *Purchased.*

Dorchester Rural District Council. Bye-Laws made by, with respect to New Streets and Buildings. (The Public Health Act, 1895.) (The Public Health Acts Amendment Act, 1890.) 59 pp., 8vo. Dorchester, 1896.

——— Report to the Sanitary Committee on a general scheme of Water Supply for the Parish of Maiden Newton. 3 pp., f.cap. Dorchester, 1896. *Frederick W. Mager.*

Firth, *Surgeon-Major R. H., F.R.C.S.* (*See* **Notter,** *Prof. J. L.*)

Gloucester. Epidemic of Small-pox, 1895-6: Report of the Committee appointed by the Board of Guardians to organise and carry out the general Vaccination of the City and District. 52 pp., 8vo. Gloucester. *Jenner Society.*

Klein, *E., M.D., F.R.S.* Micro-organisms and Disease: an Introduction to the Study of Specific Micro-organisms. 583 pp., 8vo. London, 1896. *The Author.*

Local Government Board. Twenty-Fourth Annual Report of, 1894-95. Supplement in continuation of the Report of the Medical Officer for 1894-95, on Oyster Culture in relation to Disease. 200 pp., 8vo, Plates and Maps. London, 1896.

——— Dr. R. Bruce Low's Report on the Continued Prevalence of Enteric Fever in the County Borough of Middlesborough, and on Sanitary Administration by the Town Council. 22 pp., fcp. London, 1896.

——— Dr. R. Deane Sweeting's Report on the Prevalence of Diphtheria in the Gillingham Urban District, with especial reference to the question of Restriction on School Attendance. 7 pp., fcp. London, 1896.

——— Seventeenth Annual Report, 1887-88. Supplement in continuation of the Report of the Medical Officer for 1887—Diarrhœa and Diphtheria. 153 pp., fcp. London, 1889. *R. Thorne Thorne, C.B., F.R.S.*

Massachusetts State Board of Health. Twenty-Seventh Annual Report, 1895. 807 pp., 8vo. Boston, 1896. *The Board.*

Meat, *Inspectors of.* Return (House of Commons) showing—(1) The number of Officials employed as Meat Inspectors in London, Liverpool, Manchester, &c.; (2) Date of their appointment; (3) Qualifications for appointment; (4) Vocation prior to receiving appointment; and (5) Whether such Officials act as Meat Inspectors only, or hold any office of emolument in the Department other than that supervised by the Medical Officer of Health. 10 pp., fcp. London, 1896. *Purchased.*

Mullins, *George Lane, M.A., M.D.* New South Wales as a Health Resort for British Consumptives. 3 pp., 4to. Sydney, 1896. *The Author.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Derbyshire, 1894 ..	.. *Prof. W.H. Corfield, M.A., M.D. (Oxon.)*
Dublin, 1895	.. *Sir C. A. Cameron, D.P.H. (Camb.),*
Durham, 1890, 1891, 1892, 1894.	*T. Eustace Hill, M.B., B.Sc., F.I.C.*
Lancaster C. C., 1895	.. *Edward Sergeant, M.D.*
Port of London, Half Year ending 30th June, 1896	.. *W. Collingridge, M.A., M.D.*
Sheffield, 1895 ..	.. *Prof. W.H. Corfield, M.A., M.D. (Oxon.)*
St. Mary, Battersea, 1895 ..	*Do.*

New Jersey State Board of Health. Sixteenth Annual Report of, and Report of the Bureau of Vital Statistics, 1892. 590 pp., 8vo. Trenton, N.J., 1892. *Prof. W. H. Corfield, M.A., M.D. (Oxon.)*

New South Wales. Municipal Directory and Local Government Blue Book for 1893-4. 404 pp. 8vo. Sydney, 1893.

——— Seventh Annual Report of the Metropolitan Board of Water Supply and Sewerage, 1894. 71 pp. 8vo. Sydney, 1895. *The Agent-General for N.S.W.*

Notter, *Prof. J. L., M.A., M.D., and* **Firth,** *Surgeon-Major R. H., F.R.C.S.* The Theory and Practice of Hygiene. 1034 pp., 8vo. London, 1896. *Prof. J. Lane Notter.*

Ontario. Fourteenth Annual Report of the Provincial Board of Health, 1895. 277 pp., 8vo. Toronto, 1896. *The Board.*

Paris. *Direction des Travaux de.* Notes à l'appui du compte des dépenses de l'Exercice, 1895. 274 pp., 4to. Paris, 1896.

——— *Direction des Travaux.* Notes à l'appui du compte des dépenses de l'Exercice, 1895. Service de l'Assainissement. 46 pp., 4to. Paris, 1896. *M. Bechmann.*

Patent Office. Abridgements of Specifications, period 1884-88. Class 8, Air and Gases—compressing, exhausting, moving, and otherwise treating. 9, Ammunition, torpedoes, explosives, and pyrotechnics. 11, Artists' instruments and materials. 14, Beverages. 16, Books. 17, Boots and Shoes. 19, Brushing and Sweeping. 22, Cements and like compositions. 23, Centrifugal Drying, Separating, and Mixing Machines and Apparatus. 26, Closets, Urinals, Lavatories, and like Sanitary Appliances. 28, Cooking and kitchen appliances. 29, Cooling and Ice-making. 31, Cutting, punching, and perforating paper, leather and fabrics. 33, Drains and Sewers. 40, Electric Telegraphs and Telephones. 42, Fabrics. 43, Fastenings—dress. 46, Filtering and otherwise Purifying Liquids. 58, Grain and Seed Treating. 59, Grinding, Crushing, Pulverising, and the like. 70, India Rubber aud Gutta-percha (including Plastic Compositions and materials of constructive utility other than Metals and Stone. 72, Iron and steel manufacture. 82, Metals and alloys. 88, Music and Musical Instruments. 97, Philosophical Instruments. 101, Printing other than Letterpress or Lithographic. 104, Railways and Tramways. 111, Sewage, treatment of. 116, Shop Fittings and Accessories. 117, Sifting and Separating. 141, Wearing Apparel. 145, Wood and Wood-working Machinery. 4to. London, 1896. *H.M. Patent Office.*

Portsmouth Water Works Company. Report. 14 pp., 8vo. Portsmouth, 1889. *W. Whitaker, B.A., F.R.S.*

Reid, *Arthur H., F.R.I.B.A.* Hygiene and Sewage Disposal. 24 pp., 8vo. Johannesburg, 1896. *The Author.*

Reynolds, *Arthur Rowley, M.D.* Degeneracy; its Causes and Prevention. 11 pp., 8vo. Reprint from the Journal of the American Association, October 31st, 1896. *The Author.*

Rouen. *Conseil Central d'Hygiène Publique.* Travaux du Conseil Central pendant l'année, 1890, 1892, 1895 (3 Vols.). 8vo. Rouen, 1891-93-96. *Prof. W. H. Corfield, M.A., M.D. (Oxon.)*

Russell, *Jas. B., B.A., M.D., LL.D.* A Popular Exposition of the Modern Doctrine of Tuberculosis, with applications. 31 pp., 8vo. Glasgow, 1896.

——— On the Prevention of Tuberculosis. 49 pp., 8vo. Boston, 1896.

——— Dead Meat Inspection; the Detective System *v.* the Clearing House System. (Presidential Address at Congress of Sanitary Association of Scotland, at Dumfries, September, 1896.) 22 pp., 8vo.

——— Address on the Physical Laws which govern the Distribution of Infection. 12 pp., 8vo. 1896. *The Author.*

Switzerland. Statistique de la Suisse, 108^{e} livraison. Mouvement de la Population de la Suisse pendant l'année, 1895. 33 pp., 4to. Berne, 1896. *Bureau de Statistique.*

United States. Eleventh Census, 1890: Vital Statistics of New York City and Brooklyn, Boston and Philadelphia, and Districts of Columbia and Baltimore; covering a period of six years ending May 31st, 1890. (3 Vols.) 4to. Washington, 1893-95.
Prof. W. H. Corfield, M.A., M.D.(Oxon.)

United States Army. Index Catalogue of the Library of the Surg.-General's Office. Second Series, Vol. I. A.–Azzuri. 828 pp., 4to. Washington, 1896. *The Surg.-General, U.S. Army.*

Wilson, *Hector McLean, M.D., B.Sc.* Cottage Sanitation in Rural Districts. 32 pp., 8vo. London, 1896. *The Author.*

Wilson, *James, M.A., B.Sc.* The Results of the Use of Tuberculin in the Castlecraig herd, belonging to Sir T. D. Gibson-Carmichael, Bart, M.P. 15 pp., 8vo. Edinburgh, 1896.
Geo. P. Johnston (Publisher).

Wollny, *Dr. Ewald.* Die Zersetzung der organischen stoffe und die humusbildungen mit Rücksicht auf die Bodencultur. 479 pp., 8vo. Heidelberg, 1896. *The Author.*

Woodhead, *German Sims, M.D. (Edin.).* Bacteria and their Products (Contemporary Science Series.) 459 pp., 8vo. London, 1892.
Purchased.

NOTES ON LEGISLATION AND LAW CASES.

Prepared by A. Wynter Blyth, Barrister-at-Law.

QUEEN'S BENCH DIVISION.

Before Lords Justices Grantham and Wright.

VESTRY OF ST. JOHN, HACKNEY, *v.* HUTTON.

(*Times, Nov. 4th,* 1896.)

The Sanitary Authority under the Public Health (London) Act is the judge as to whether closet accommodation is insufficient.

This was a special case stated by a metropolitan magistrate on the hearing of a summons under the Public Health (London) Act, 1891, against the owner of 110, Southgate Road, for having an insufficient and improper water-closet on the premises, notwithstanding directions specified in a notice served on him by the vestry, the sanitary authority, to rectify the same. The summons was dismissed by the magistrate. The case was stated in pursuance of an order by the Court of Queen's Bench. The owner was summoned on May 16th, 1895, by the vestry of the parish of St. John, at Hackney, for not having any water-closet accommodation on the premises. The magistrate visited the premises and found, as a fact, that there was water-closet accommodation. On August 2nd the owner was again summoned under the Act of 1891, by the vestry, for having insufficient water-closet accommodation. The magistrate thought the matter was not a question of public health, but really arose out of a dispute between the landlord and tenant; the latter alleging that the landlord had agreed to erect another water-closet on the premises, while the landlord alleged that there was only a conditional promise if the tenant was a satisfactory tenant to him. The magistrate adjourned the case for six months, to give the tenant an opportunity of bringing an action in the County Court if he desired to do so. At the end of that period, no such action having been brought, the magistrate dismissed the summons. The question for the Court now was whether, under the circumstances, the magistrate was bound by the decision of the sanitary authority.

Mr. Beven appeared for the sanitary authority, the appellants.

Mr. CARRINGTON appeared for the respondent, and contended that the magistrate had power to dismiss such an information. There were two courses open to the sanitary authority. They might either ask for a fine or do the work for themselves and recover the expenses. In Section 36 of the Public Health Act, 1875, the authority could only call on the person to do the work, and, if he neglected, do it themselves. In such cases the magistrate acted ministerially. But he acted judicially in cases under the Act of 1891, by which the matter was made a criminal one. By Section 251 of the Act of 1875, which was the same as Section 117 in the Act of 1891, provision was made for recovery of expenses. That was one proceeding. Criminal proceedings were different: in them the sanitary authorities ought not to be judges. It was quite true to say that there was an appeal under Section 37 of the Act of 1891 to the County Council, but that did not affect the powers of the magistrate. If the magistrate thought the matter was vexatious, he surely ought not to be obliged to punish. He said here he considered the matter not one of public health at all, and that was the reason why he dismissed the summons.

Mr. JUSTICE GRANTHAM said the magistrate was bound to convict. Whether it was wise for the Legislature to make the sanitary authority judges was perhaps open to question, but he thought it had done so. There was another question that arose, and that was whether the magistrate could refuse to inflict any fine at all. That, however, was not a question directly before the Court, and it was wiser, therefore, to express no opinion as to it.

Mr. JUSTICE WRIGHT concurred, but he desired to add that, in his opinion, the magistrate might, instead of proceeding at once to a conviction, adjourn the case to give an opportunity of an appeal to the County Council. The only questions for the magistrate were whether the notice had been served, whether the person on whom the notice was served was the owner, whether the time allowed was reasonable, and whether the work had been done in accordance with the notice. The case must go back to the magistrate with this expression of opinion.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Before MR. JUSTICE KEKEWICH.

THE ATTORNEY-GENERAL *v.* TOD-HEATLY AND OTHERS.

(*Times L. Rep. Nov.* 25*th*, 1896.)

In a case of nuisance on vacant land in the Metropolis on which the public deposit refuse, and in respect of which refuse special powers are given by the Public Health (London) Act, 1891, *Sect.* 31, *to the local authority to remove such refuse charging the owner for the removal, the Court refuses to grant an injunction against the owner.*

This was an action by the Attorney-General at the relation of the united vestry of the parishes of St. Margaret and St. John the Evangelist, Westminster, as plaintiffs, to restrain an alleged nuisance said to be existing on a piece of land at the corner of St. Ann's-lane and Great Peter Street, Westminster, which formerly belonged to the defendant Mr. Tod-Heatly, but had since come into the possession, by purchase, of the defendant Sir Henry Moore Brownrigg. The buildings formerly upon the land were pulled down as long ago as 1882, and the site was then surrounded by a hoarding. No new buildings had yet been erected there, and it was said that the hoarding had fallen out of repair and that the land had been used as a receptacle for dead dogs and cats, offal, and all kinds of filth and refuse, and for other objectionable purposes; also that squatters with caravans had settled down on the land, and that it had been, and was being, used by showmen, who attracted noisy, dirty, and riotous crowds by playing hand organs and other loud instruments. The plaintiffs complained that the condition of the land and the uses to which it was being put were such as to constitute a serious nuisance to the inhabitants of the parishes and to be injurious to the health of the people living near the land. On behalf of the defendant Sir H. M. Brownrigg, it was said that in January last his agent wrote to the solicitor to the vestry stating that in future no shows would be allowed on the land, but pointing out that it was impossible for an owner of the land, unless he was also the occupier, to prevent people from throwing refuse over the hoarding or breaking it up, and suggesting that the vestry should send their dustmen to visit the land periodically and keep it clean; also that they should use their influence with the police to stop the damage to the hoarding and the deposit of filthy matter. It appeared that the gradual accumulation of garbage and rubbish had caused the land to be raised some two feet above the adjoining roadway, so that in wet weather foul water poured on to it. The real question at issue appeared to be whether the duty of keeping the land clean and in order devolved upon Sir H. M. Brownrigg or upon the vestry, under the provisions of the Public Health (London) Act, 1891.

Mr. Warrington, Q.C., and Mr. Morton Smith appeared for the plaintiffs; and Mr. Renshaw, Q.C., and Mr. Ingpen for the defendants.

Mr. Justice Kekewich said that with regard to Mr. Tod-Heatly, the original defendant, he had had notice given him to come and ask for his costs. He had been made a defendant in the belief that he was owner of the land, which he was not. He must, therefore, have his costs. With regard to Sir H. Brownrigg, the plaintiffs' claim asked for an injunction against his "allowing the land to be and to remain in such a state as to be a nuisance or injurious to health." The first question was whether Sir H. Brownrigg had a duty to perform towards the public. His Lordship could not conceive it possible to argue that a man owning a piece of land in the centre of a town was not bound so to use that property of his that it should not be injurious to his neighbours. That was an imperative duty upon him. If there had been the slightest evidence that Sir H. Brownrigg had shown negligence in his duty and had set at naught the obligation that rested on him, his Lordship would have been disposed to regard him with much less favour than he was disposed to regard him at present. But he had not left the land alone to its fate. The evidence showed there had been a nuisance on the land from time to time. The question then arose, What was to be done? By Section 13 of the Public Health (London) Act, 1891, the vestry were empowered to take proceedings in the High Court to enforce the abatement or prohibition of any nuisance. And they had another remedy given them by section 35, which empowered them to serve notice on the "owner" of any obnoxious matter or the occupier of the premises on which it existed to remove the same, and if the notice was not complied with, then to remove the matter themselves and to recover in a summary way the expenses from the former owner of the matter removed or from the owner or occupier of the premises. That provision was to prevent the vestry from being trespassers by going on the land to remove the matter. That provision had been found to work well in similar Acts. It was the authority by which towns were kept reasonably clean and wholesome. Was that a sufficient answer to a claim for an injunction? Sir H. Brownrigg had a duty to perform. Could he properly perform it, do what he would? Hoardings, however strong, might be broken through. To say that he must keep watchmen on the land day and night would be to impose on him a very serious duty indeed, far greater than he could reasonably be expected to perform, and the only way to test the question whether he had performed his duty would be by motion to commit for breach of the injunction. That was not the sort of thing one wished to promote. As against that there was the 35th section, under which the vestry could remove the obnoxious matter and Sir H. Brownrigg would have to pay the expense of it. Upon that there was this difficulty—that the Court might seem to be absolving him from his duty as regarded this property. It looked as if Sir H. Brownrigg might go away and snap his fingers at the vestry, and say to them, "You have to do it." His Lordship's view was that he ought not to impose on him that serious duty which he could not reasonably be expected to perform. Upon the whole, he thought that Sir H. Brownrigg was entitled to have the action dismissed so far as it sought to restrain him from allowing the land to be and to remain in such a state or to be used in such a manner as to be a nuisance or injurious to health.

COURT OF APPEAL.

Before Lord Esher and Lords Justices Kay and Smith.

THE TOTTENHAM URBAN DISTRICT COUNCIL *v.* WILLIAMSON AND SONS, LTD.

(*L. T. n. s. Vol. LXXV.*, 238).

The proceedings in a superior Court with regard to the abatement or prohibition of nuisance sanctioned by Sect. 107 *P. H.*, 1875, *create no new remedy.*

The ordinary law is that a person complaining of nuisance must apply for the fiat of the Attorney-General before he can bring an action, unless he can allege special damage to himself. In this case the action was brought by a local authority to compel the defendants to abate the nuisance derived from decomposing garbage, and an order for an interim injunction having been obtained, Justice Day discharged the injunction on the ground that the action as brought was not maintainable. The plaintiffs appealed, but the Court dismissed the appeal.

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